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ABSTRACT

This curriculum guide contains operational guidelines to help local administrators, teacher educators, and industrial arts teachers in the State of Louisiana determine the extent to which their programs are meeting the needs of the youth they serve. It consists of a discussion of course prerequisites, goals, content, and implementation as well as 18 units devoted to various subject areas addressed in industrial arts programs. Covered in the individual units are American industry careers, general safety, technical sketching and drawing, layout and measurement, hand tools, industrial materials, basic combining processes, portable power tools, organizing and controlling work, stationary power tools, mass production concepts, materials processing, finishing, materials and equipment, planning and design, home maintenance, and energy orientation. Each unit contains a statement of purpose, goals, time allotments, student activities, teacher activities, and resources. Among those items provided in the guide's appendixes are lists of equipment, job sheets, information sheets, safety information, parts identification of tools, sample tests, a selected bibliography, and project ideas. (MN)

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STATE OF LOUISIANA

DEPARTMENT OF EDUCATION

BULLETIN NO. 1683

INDUSTRIAL ARTS CURRICULM GUIDE

in

GENERAL INDUSTRIAL ARTS

Issued by

Office of Vocational Education

N. J. Stafford, Jr., Ed.D.
Assistant Superintendent

J. KELLY NIX
State Superintendent

ED 234 372

U.S. DEPARTMENT OF EDUCATION
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FOREWORD

This publication is a guide for the improvement of instruction in Industrial Arts Education for the State of Louisiana. It should be of benefit to industrial arts teachers, supervisors, counselors, and administrators. These operational guidelines will help local administrators, teacher educators, and industrial arts teachers to determine the extent to which their programs are meeting the needs of our youth. Industrial Arts Education Programs must be organized to meet the needs of all students.

A constant concern for educators is the construction and revision of curriculum. Industry and technology are the core of industrial arts instruction. Both are constantly changing; therefore, curriculum and instruction must change in order to provide students a realistic and accurate understanding of industry and its function in our complex technological society.

J. KELLY NIX
State Superintendent of Education

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The following teachers spent many hours writing, field testing, and completing these guidelines: Michael Beauvais, John M. Lee, James W. Parker, H. Carl Schaff, Nathaniel C. Johnson, Raphael N. Songy, and Samuel O. Spears.

N. J. Stafford

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GENERAL INDUSTRIAL ARTS

Course Description:

This course is designed as an introductory course into the world of technology and industry. The course is designed to provide basic and varied opportunities for students in a broad range of subject areas and activities. Students will design, plan and build projects and "mini projects" by using hand and power tools.

Target Grade Level:

This course is designed for grades 9 through 12. It is a prerequisite course and must be taken by all students before entering into any of the other industrial arts courses with the exception of the Technical Drafting courses. It is also suggested that this be a prerequisite course for many of other Vocational courses.

Prerequisite: NONE

General Program Goals and Objectives:

The study of General Industrial Arts should provide students:

1. Learning experiences which will assist them in identifying and evaluating their personal interests, abilities, values and needs as they relate to the needs of our industrial/technical society.
2. Foundations and exploratory experiences in many basic areas leading to further progress in other courses of interest.
3. The opportunity to develop general and specific problem solving and creative abilities involving the tools, materials, processes and products of industry.
4. Broad introductory experiences in many occupational clusters.

Space Allocation, Placement of Equipment and Traffic Flow

As a general rule, all machines, benches and laboratory equipment should be surrounded by a minimum of 3 feet of clear space. Certain machines such as cut-off saws, shears, jointers, planers, drill presses and lathes may need more space to accommodate the long materials that are ordinarily processed with these machines.

Major aisles should have a minimum width of 4 feet, while secondary walkways should be at least 3 feet.

Sufficient open floor space to prevent crowding and interference among students must be provided around all doorways, in project assembly areas, demonstration areas, around tool cribs and tool panels and near material storage areas.

Machines that are more than 4 feet in height should be placed toward the outside of the room so that visibility will not be obstructed.

The following space recommendation table is from the 1974 "Guide to Preparing Educational Specifications for Secondary Industrial Arts Facilities," published by the American Council of Industrial Arts Supervisors.

An Example of Space Recommendations for Traditional Industrial Arts Courses:

(Figures in Square Feet per Student)

	Minimum	Adequate	Desired
General Shop	80	100	125
Crafts	75	100	125
Metals	75	100	125
Drafting	40	50	60
Ceramics	60	70	80
Electricity	60	70	80
Woods	80	100	125
Power Mechanics	75	80	100
Plastics	60	70	80
Graphic Arts	75	80	100

These space suggestions do not include storage areas, finishing rooms, planning areas, or other similiar allied areas.

More detailed space allocations for machines listed in this publication can be found in the "Guide to Equipping Industrial Arts Facilities" by the American Industrial Arts Association, 1914 Association Dr., Reston, VA 22091.

CONTENT OUTLINE

		Estimated minimum coverage time in weeks
I.	INTRODUCTION TO AMERICAN INDUSTRY/CAREERS	1
II.	GENERAL SAFETY	1
III.	TECHNICAL SKETCHING AND DRAWING	2
IV.	BASIC LAYOUT AND MEASUREMENT	1
V.	BASIC HAND TOOLS	1/2
VI.	BASIC INDUSTRIAL MATERIALS	1/2
VII.	BASIC COMBINING PROCESSES	1
VIII.	BASIC PORTABLE POWER TOOLS	1/2
IX.	ORGANIZING AND CONTROLLING WORK	1/2
X.	BASIC STATIONARY POWER TOOLS	1/2
XI.	MASS PRODUCTION CONCEPTS	1
XII.	BASIC MATERIALS PROCESSING	1
XIII.	FINISHING	1
XIV.	RELATED SUBJECT AREA(S) MATERIALS AND EQUIPMENT	1
XV.	RELATED SUBJECT AREA(S) PLANNING AND DESIGN	3
XVI.	RELATED SUBJECT AREA(S) SAFETY REVIEW	1/2
XVII	HOME MAINTENANCE APPLICATIONS	1
XVIII.	ENERGY ORIENTATION	1

All major headings that are marked with an asterisk (*) under the TOPICS column must be adequately covered to meet the recommended state guidelines for minimum subject area coverage. The headings not marked are optional topics and may be taught at the individual teacher's discretion. All formal testing should be directed at the marked headings. These marked items will give a minimum coverage of 18 weeks for a 1/2 credit course.

All sequencing, time allotments, student activities and resource data are suggested only.

UNIT TITLE I INTRODUCTION TO AMERICAN INDUSTRY/CAREERS

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is intended to familiarize Industrial Arts students with the general organization and function of industry in the United States. It is expected that teachers will substantially enhance this unit by providing ample opportunity for student project work which will simulate the production processes of industry.	Students will be able to investigate the background, materials, processes, and products of industry. In addition, they will be exposed to major industrial occupational clusters in order to help them make sensible choices in their own eventual career planning.	This unit, properly presented, should help students: Develop an interest in industry. Develop an awareness of major career opportunities related to industry. Develop consumer knowledge of good design and quality workmanship, and learn to select industrial products wisely. Make reasonable initial and tentative choices of possible careers in industry.

UNIT I INTRODUCTION TO AMERICAN INDUSTRY/CAREERS

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit students should be able to: Chronologically list major inventions and inventors in American industry and technology.	*A. Origin and Background 1. Development of tools 2. Movable type printing press 3. Industrial Revolution a. Steam engine b. Cotton gin 4. Mass Production a. Interchangable parts b. Assembly line c. Job specialization d. Jigs and fixtures e. Special purpose tooling 5. Automation a. Technical change b. Efficiency engineering (labor)	Study appropriate text chapter. Answer study questions. List objects in home made by mass production methods in industry.	Display pictures of early tools and equipment. Show films on industry. Lecture and discussion. Brief class on the mass production concept. Show films.	Films: "Tools That Shaped America" by Amalgamated Meat Cutters "Wealth Out of Waste" by Bureau of Mines "This Is Automation" by Bureau of Mines
Identify career opportunities and make tentative personal career choices in one or more occupational clusters.	*B. Occupational Clusters 1. Construction 2. Manufacturing 3. Transportation 4. Agribusiness and Natural Resources 5. Marine Science 6. Environment 7. Business and Office 8. Marketing and Distribution 9. Communication 10. Hospitality and Recreation 11. Personal Service 12. Public Service 13. Health 14. Consumer and Homemaking 15. Fine Arts and Humanities	Discuss careers with the school counselor. Collect related job opportunities from classified advertisements. List occupations of parents and classify them under a major occupational cluster. Fill out a sample job application form.	Bring in school counselor or other resource person. Distribute information about different careers.	Occupational Outlook Handbook by U.S. Department of Labor (19) P. 51-55 Employment agencies. Resource persons.

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Define concepts of production: Tooling-up Control Interchangeable Parts Mass production Mating parts Identify cutting, forming, assembling, and finishing operations in manufacturing.	*C. Trends in Technology 1. Electronic 2. Metallurgy 3. Transportation 4. Communications 5. Energy 6. Health *D. Materials (raw materials and their sources) *E. Processes (making a product using machines, equipment and tools). *F. Products (manufactured items and sales).	Disassemble a product that has several parts, and discuss each part in relation to price, raw material, production, industries involved, etc. Visit an electrical power plant. List five products made from raw materials found in the old appliance that they have previously taken apart. Study the manufacturing process of the item under trends in Technology. Discuss resources duplicated and distributed by the instructor.	Bring in an old appliance. Discuss ecology, recycling, pollution, etc. Plan a field trip to newspaper, power plant, etc. Distribute flow charts showing the order in which operations are performed to make a product. Distribute handouts.	Local repair shop Components plant Power plant Printing plant Fabrication plant Old appliance (1) P. 72 (1) P. 55-60

UNIT TITLE II GENERAL SAFETY

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is included to help the teacher in the incorporation of safety education into the industrial arts program. By treating safety education as an integral part of the total program rather than as a separate subject, a high level of safety consciousness can be maintained. This unit should be a vehicle for improving safety instruction and for building strong positive safety attitudes and work habits. Such a program will result in the prevention of accidents, and will help reduce the teacher's possible exposure to litigation.	Through an effective accident prevention program industrial arts teachers and school administrators must become more knowledgeable and teach students to protect themselves and others against dangerous and potentially dangerous situations. This unit should teach safety attitudes that last a lifetime.	As a result of learning experiences gained through this unit, students and teachers should become more knowledgeable and aware of safety. Eye and ear protection are extremely important areas of emphasis. Electrical and fire areas are also of vital importance in a safety education program. Personal protection is vital to our citizenry and this unit should provide the topics and means of preventing accidents.

UNIT II GENERAL SAFETY

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit the student should be able to: Explain the reasons and advantages for having safety guidelines. Identify general safety guidelines for Industrial Arts. Discuss the needs and importance of eye protection. Select the proper type of eye protection for a given potentially hazardous situation or task.	*A. What have you got to lose? 1. Your eyes 2. Your hearing 3. Your hands 4. Your legs 5. Your back 6. Your life *B. General safety instruction. *C. Eye Protection 1. Types of eye hazards 2. Appropriate eye protection devices for various hazards 3. Reasons for eye protection 4. Consequences of not wearing appropriate eye protection (injuries, etc.) 5. Proper maintenance of eye protection products 6. What to do in case of an eye injury	Discuss the value and "replacement value" of their eyes, hearing, hands, legs, back, and life. Explain what life would be like without the use of their eyes, hearing, hands, legs, and back. Take notes in notebook. Take safety test. Inspect the various types of eye protection devices and insure that they are in proper working order. Examine an artificial eye as a possible substitute for their own. Study handout on applications of eye protection. In pairs, blindfold each other and tour the classroom or laboratory.	Show transparency "What Have You Got To Lose?" Show a safety film depicting typical accident situations. Contact a safety representative from a local industry to speak to the class on the importance of a positive safety attitude. Discuss and review "General Safety Instructions For All Areas of Industrial Arts." Administer Safety Test. Share information on eye protection. Obtain information on eye related accidents, and other information from the National Society for the Prevention of Blindness and the National Safety Council. Distribute and review handout on use of various eye protective devices. Show film if appropriate.	(16) P. 5-1.02 Resource Person (16) P. 5-4.01 (16) P. 3-15 N.S. P. 3-15

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Explain the importance and significance of good housekeeping.	*D. Housekeeping 1. Housekeeping as accident prevention 2. Good housekeeping practices 3. Elements of a good plan for housekeeping 4. Items necessary for housekeeping	Organize a clean-up roster for housekeeping by suggesting each of the items that will require daily cleaning.	Organize and implement an effective plan/schedule of housekeeping.	(16) 3.01-3.02
Identify electrical hazards on sight and take appropriate precautionary action. List examples of common unsafe acts that result in electrical accidents or injury. List the most common causes of electrically related accidents.	*E. Electrical Safety 1. Nature of electrical accidents 2. Causes of electrical accidents a. Defective equipment b. Unsafe practices 3. Avoiding electrical accidents	Discuss electrical safety hazards and list unsafe electrical conditions found at home and school.	Compile a list of unsafe electrical conditions found at school and submit it to the principal. As appropriate, rectify or remove any electrical hazards found in the industrial arts lab.	(16) P. 3.03-3.05
List the locations of fire alarms and explain the proper procedure to evacuate the lab in case of fire. Identify appropriate types of fire extinguishers. List the various classes of fires.	*F. Fire Safety 1. Fire alarm and evacuation procedures 2. Fire extinguishers a. Classes (types) b. Uses c. Method of operation d. Range e. Maintenance 3. Location of fire extinguishers 4. Underwriters Laboratories Standards	List the location of fire alarms and extinguishers. Practice evacuation of lab/classroom in case of fire. Draw a chart listing the various classes of fire extinguishers, their uses, their methods of operation and their identifying characteristics.	Explain and post the location of fire alarms and the proper evacuation routes. Show and explain a transparency on fire extinguishers. Demonstrate the proper use of fire extinguishers. If feasible, contact fire department to put on demonstration.	(16) P. 3.08

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Locate all fire extinguishers in the lab/classroom. Define Underwriters Laboratories. Describe various types of flammable materials and list the proper storage procedure for each. Locate and operate shut-offs for gas/oil fired equipment.	b. What does the UL tag mean? c. What is the purpose of Underwriters Laboratories Materials? 5. Storage of flammables a. Flammable liquids b. Oily materials c. Paint soaked rags d. Others 6. Location of shut-offs for gas/oil fired equipment.	List the location of all emergency/ auxiliary shut-offs and explain the procedure for operating them.	Contact Underwriters Labs for free or low cost fire safety instructional materials.	
List personal protective devices for the head, eyes, ears, face, respiratory system, torso, and limbs.	*G. Personal Protection 1. Head 2. Eye-face 3. Respiratory 4. Body H. Personal Practices 1. Conduct 2. Orderliness	Discuss the merits of various personal protective devices and the consequences of failing to use them.	Gather samples of each type of personal protective devices. Show transparency of "Unsafe Worker" and have students identify potential safety hazards.	(16) P. 21
Demonstrate and apply the proper procedures for lifting heavy materials. Describe the procedures for handling long, hot or sharp objects.	*I. Materials Handling 1. Proper lifting procedures 2. Danger of improper lifting procedures 3. Carrying Materials a. Long Objects b. Hot Materials c, Sharp Materials	Analyze and discuss the proper procedure for lifting heavy objects. Using an empty cardboard box practice the proper lifting procedure.	Using transparency, explain the proper procedure for lifting heavy objects. Explain the hazards of lifting heavy objects over your head.	(16) W.S. S- 3.07

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Identify noises exceeding safe acceptable levels for a given time period.	*J. Hearing Conservation 1. Noise Levels a. Measured in decibels b. Comparable dB levels with ordinary noise 2. Noise exposure 3. Hearing protection devices a. Muffs b. Plugs c. Air Cushioned pads	If available use a type 2A sound level meter to monitor noise levels throughout the school. Where levels exceed 85 dB, calculate allowable duration per day/hour.	Contact a local industrial concern, or group of safety engineers to demonstrate a Type 2A sound level meter. Show examples and proper uses of various types of hearing protectors.	(16) P. 3.17- 3.18 3.19 Appendix chart
Report all accidents/injuries that occur in class or the lab in the correct manner.	K. Accident reporting 1. Report all accidents 2. Emergency procedures	Fill out a mock accident report. Analyze accident reports for the purpose of aiding in the prevention of future accidents.	Require all students to report <u>all</u> accidents. Record and report all accidents to the appropriate administrator. Review other appropriate safety materials shown in appendix	

UNIT TITLE III TECHNICAL SKETCHING AND DRAWING

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is devoted to the development of a general understanding of the role of technical drawing in product development and manufacturing. Students should be made aware that the ability to execute, read and understand drawings is crucial to manufacturing and industry.	General Industrial Arts students, through basic study and practice in this unit, will be prepared to execute and utilize working drawings. Additionally, they should learn to use basic technical drawing equipment and techniques in such a manner that they may prepare creative and productive technical drawings.	As a result of learning experiences during this unit, students should acquire sufficient basic skills to aid their self-expression on paper. Familiarity with sketching, lettering, and formal drawing will allow Industrial Arts students to understand the significance of the planning and designing phases of U.S. industry.

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UNIT III TECHNICAL DRAWING AND SKETCHING

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit, students should be able to: Express ideas on paper through controlled sketching. Differentiate between various types of common pictorial views.	*A. Sketching Basics 1. Line development 2. Sketching objects in three views. 3. Isometric sketching 4. Perspective sketching 5. Oblique sketching 6. Grid enlarging or reducing 7. Solid sketching on graph paper	Complete acceptable sketches of his home (or given objects).	Introduce and demonstrate the alphabet of line(s) and the basic pictorials and three view projection.	Overhead Projector (1) P. 103-107
Correctly identify and use basic drawing equipment.	*B. Basic drawing equipment 1. Drawing board 2. T-Square 3. 30°-60° and 45° triangles 4. Compass 5. Dividers 6. Scales 7. Drafting machine	Prepare a silhouette chart of equipment items and their correct names.	Present an opaque project demonstration of basic drawing tools. Discuss proper use of each.	(1) P. 115-120 Opaque Projector
Read common rule to an accuracy of 1/32" or 1 millimeter.	*C. Rule Reading Skills 1. Whole feet and inches 2. Reading 1/2,1/4,1/8,1/16 inches 3. Reading whole meters, decimeters, centimeters, and millimeters.	Measure handouts, school newspapers, desk tops to acceptable accuracy levels.	Positively insure minimum competency in basic measurement by each student.	(1) P. 97, 100
Letter a given paragraph legibly and consistently, using standard letter form and light lettering guidelines.	*D. Freehand lettering skills 1. Use of guidelines (1/8" and 3/16") 2. Correct shaping and stroke sequence a. Vertical capitals b. Numerals and fractions 3. Correct line weight (darkness)	Prepare a hand lettered name tag for a textbook cover or desk plate.	Conduct appropriate engineering lettering drill exercises.	(1) P. 110

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Correctly read dimensions to given tolerances.	*E. Tolerances and allowances 1. Dimensions format 2. Machine shop applications 3. Manufacturing implications	Read and interpret given tolerances from selected drawings.	Explain principle of Go-No-Go gauges.	Sample industrial drawings using tolerance dimensions
Select a correct missing view from several view solutions.	F. Shape Description 1. Orthographic projection 2. Multi-view drawings 3. Spacing of views 4. Hidden lines	Complete three view sketching problems on grid paper.	Prepare practice problems	(1) P. 127-8
Identify all lines and symbols used in standard dimensioning practice.	G. Size description 1. Extension lines 2. Dimension lines 3. Arrowheads 4. Center lines 5. Leaders 6. Placement of dimensions 7. Dimensioning circles, holes and arcs 8. Dual Dimensioning (English and Metric measurements)	Dimensioning of three view problems.	Practice practice problems	(1) P. 102,111-114
Locate and read details from selected working drawings.	H. Working drawings 1. Definition 2. Developing 3. Reading	Bring in an acceptable set of plans from a periodical.	Distribute and explain appropriate samples of working drawings.	Sample industrial working drawings (1) P. 129
Identify key basic drawing symbols.	I. Symbols 1. Section drawing symbols 2. Floor planning symbols 3. Machine drafting symbols a. Finish marks b. Schematic/Simplified threads	Review given examples.	Display charts selected symbols. Discuss reasons for symbols.	(1) P. 114

UNIT III TECHNICAL DRAWING AND SKETCHING

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Locate and read detailed views from selected blue-prints.	J. Blueprint reading	Read blueprint.	Provide appropriate prints.	Sample industrial blueprints
Discuss basic elements of good design.	K. Factors in designing 1. Refinement of solution ideas 2. Function, utility 3. Unity, Balance, Harmony 4. Form, Texture, Color 5. Pattern repetition 6. Key feature	Bring in pictures or real objects which display good design qualities.	Lead a general discussion using examples brought in by class.	Selected blueprint reading workbooks and textbooks. Periodicals from home.

UNIT TITLE IV BASIC LAYOUT AND MEASUREMENT

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
The purpose of this unit is to assure that all Industrial Arts students receive formal, standarized training in specific measurement and layout requirements. It is directed toward pre-vocational shop math requirements. Teachers are encouraged to invite the use of the popular hand calculators during this unit.	The students will be able to correctly measure within given performance standards and perform selected layout operations. In addition, students will become generally familiar with metric measurement requirements.	As a result of satisfactorily completing this unit, students should be able to: Feel capable of completing basic standard and metric measurements. Correctly divide, multiply, add, subtract, and reduce fractions. Set up and complete basic math problems involving various area, volume, and percentage computations.

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UNIT IV BASIC LAYOUT AND MEASUREMENT

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit, students should be able to: Measure and make project layouts accurately. Choose appropriate layout equipment. Utilize layout equipment in the correct manner.	*A. Layout techniques 1. Parallel to edges 2. Accuracy checks a. Scratch awl line b. Pencil line 3. 3-4-5 90° triangle 4. Finding true centers of circles 5. Grid enlargement/or reduction 6. Graph paper-scaled sketching *B. Equipment 1. Layout a. Squares (1) Combination (2) Try (3) Framing (4) T-Bevel b. Rules (1) Steel tape (2) Folding rule c. Dividers	Lay out a true square and check diagonal distances for accuracy. Lay out the 3-4-5 90° triangle and verify right angle. Trace a circle with a jar or can lid and then locate the exact center geometrically. Correctly identify given drawing equipment items.	Demonstrate pencils and scratch awls (avoid felt/fiber) Project equipment items using opaque projector Brief class on correct useage	(1) P. 228-230 (2) P. 300-301 (1) P. 115-120
Complete linear measurement requirements, with an accuracy of ± 1/32".	*C. Reading the Rule 1. Accuracy to sixteenths 2. Measurement drill 3. Layout practice	Measure desks, texts, notebooks, etc. Review correct sizes upon completion.	Display blow-up of rule and teach fractional parts (suggest opaque projector)	(1) P. 97-100
Correctly complete given area/volume/percentage problems with a competency level of 75%.	*D. Computing area 1. Square units 2. Formula work: a. Triangles b. Rectangles c. Circles d. Combinations	Measure room and compute wall surface, ceiling, and floor area in square feet. Figure internal volume of classroom in cubic feet.	Drill class on area/volume formula work for squares/rectangles, triangles, circles, and various solids.	

UNIT IV BASIC LAYOUT AND MEASUREMENT

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	*E. Computing volume 1. Cubic units 2. Rectangular solids 3. Cylinders 4. Combinations	Compute volume of boxes, oil storage tanks, etc.	Display and discuss the decimal equivalency table.	
	*F. Figuring percentage 1. Fractional form of % 2. Decimal form of % 3. Selected problems	Complete percentage practice work and successfully pass examination of the material.	Prepare percentage practice sheets and related test(s).	
Properly measure distances within a competency level of ± 1 millimeter. List common metric units which describe areas, volumes, and liquid amounts.	*G. Metrics 1. Measurements of: a. Lengths b. Areas c. Volumes 2. Selected problems	Measure other student's heights in metrics. Pour 1 quart of liquid in a large jar and compare it to 1 liter in a similar jar.	Introduce steel tape with standard and metric units.	(1) P. 95-102 (2) P. 296-300
Convert common fractions to decimals and decimals to fractions. Correctly round off given 5-place decimal amounts to 2 or 3 places. Correctly double and halve given common fractions.	*H. Fractions and Decimals 1. The decimal equivalent table 2. Conversions 3. Rounding decimals 4. Fractions a. Addition b. Subtraction c. Doubling d. Halving e. Multiplying d. Dividing 5. Reducing fractions to lowest common denominator	Practice problems as directed. Complete fraction/decimal tests.	Prepare and execute appropriate fraction and decimal drills. Prepare and issue test(s) involving fractions and decimals.	

UNIT TITLE V BASIC HAND TOOLS

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is intended to familiarize students with the more common hand tools and their proper use. Good work habits and sensible choices of "the right tool for the job" should be stressed throughout this introductory unit. Teachers should be aware of the importance of using the correct nomenclature, as well as the need for thoroughness in initial demonstrations. Tools are presented in clusters, and all clusters are to be considered equally important. The actual tools are not necessarily required in order to introduce them to the class.	Students will be given maximum opportunity to identify, select, and handle a variety of basic hand tools.	As a result of completing this unit, students should be able to: Discuss the advantages and disadvantages of the major home and industrial hand tools. Feel safe and confident in the skills developed by using hand tools. State or list common safety precautions to be observed when using the more hazardous hand tools.

UNIT: V BASIC HAND TOOLS

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Upon completion of this unit, students should be able to: Identify, discuss, and safely use general hand tools. Discuss the topic of hand-tool safety as applied to the home and to industry.	*A. Layout and Measuring Tools 1. Rules a. Folding b. Yard stick c. Meter stick d. Bench rule 2. Steel pocket tape (inches-metric) 3. Calipers a. Outside b. Inside c. Vernier d. Spring dividers 4. Micrometers a. Standard b. Metric 5. Squares a. Try b. Framing c. Combination d. T-Bevel 6. Marking devices a. Marking gauge b. Scratch awl c. Chalk line d. Trammel *B. Driving and Impact tools 1. Twisting and turning tools a. Wrenches (1) Fixed open-end (2) Adjustable open end (3) Box (4) Combination (5) Socket (6) Torque (7) Pipe (8) Allen (9) Tap (10) Die Stock	Practice with given tools whenever feasible. Student/group projects using a variety of available hand tools. Prepare color coded or silhouetted hand tool storage panels or cabinets.	Note: When applicable, selections of tools should be made within clusters. An introduction and discussion should include: 1. Demonstration of correct use 2. Advantages/disadvantages of use 3. Safety precautions 4. Student practice/projects where appropriate	Selected tool Catalogs Text references Films/Cassettes

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	b. Screwdrivers (1) Standard (2) Phillips (3) Automatic Ratchet (4) Offset (5) Stubby 2. Impact tools a. Hammers (1) Claw (2) Ball peen (3) Plastic tipped (4) Magnetic tacker b. Mallets (1) Rubber (2) Wooden (3) Rawhide c. Sledges (1) Small (2) Large *C. Holding tools 1. Clamps a. C-Clamp b. Hand Screws c. Steel Bar d. Pipe e. Spring 2. Pliers a. Vise Grip b. Slip-joint c. Channel lock d. Diagonal cutting e. Needle nose f. Nippers g. Electrician (lineman) and other side cutting 3. Vises a. Woodworking b. Bench metal c. Drill press d. V-Block e. Pipe			48

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OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	4. Pop-rivet gun 5. Rivet set *D. Cutting Tools 1. Woodcutting tools a. Saws (1) Cross-cut (2) Rip (3) Coping (4) Keyhole/compass (5) Back (6) Miter Box Saw (7) Dovetail b. Planes (1) Jack (2) Block (3) Spokeshave (4) Rabbet (5) Surform(rasps) (a) Flat (b) Round rasp (c) Block c. Wood chisels (1) Butt (2) Firmer (3) Paring (4) Mortise (5) Carving (sets) 2. Metal Cutting Tools a. Cold Chisels (1) Flat (2) Cape (3) Round nose (4) Diamond Point b. Dies (1) Solid (2) Adjustable (3) Pipe c. Files (1) Round (2) Flat (3) Half-round (4) Triangular/Three Square			

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OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	(5) Needle (6) Auger bit d. Punches (1) Center (2) Pin (3) Drift (4) Prick (5) Solid e. Hack Saws (1) Standard-solid (2) Adjustable f. Snips g. Bolt cutters *E. Boring Tools 1. Woodworking Drills a. Hand drill b. Brace and bit c. Expansive bit d. Forstner bit e. Spade bit f. Spiral drill (Yankee-automatic) g. Counter sink bit h. Screw-Mate bit 2. Metal Working Drills a. Twist drill b. Taps (1) Taper (2) Plug (3) Bottoming (4) Pipe c. Reamers (1) Fluted (2) Expansion d. Re-Boring Bits (1) Spot face (2) Countersink (3) Counterbore *F. Miscellaneous Tools 1. Jigs and templates 2. Paint brush, roller and pad			

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	3. Glass cutter 4. Sheetmetal seamer/groover 5. Mechanical Fingers 6. Knives/scrapers a. Putty knife b. Utility knife c. Joint knife d. Pocket knife e. Cabinet knife 7. Inspection mirror 8. Wire stripper 9. Wrecking bar 10. Bolt extractors (EZYOUT) 11. Wheel Dressing Tools 12. File Card 13. Levels a. Masons b. Carpenters c. Line d. Plumb bob 14. Tubing cutter/flaring tool 15. Various Foundry Items 16. Gauges a. Screw Pitch b. Thickness c. Wire 17. Soldering Irons 18. Grease guns			

UNIT TITLE VI. BASIC INDUSTRIAL MATERIALS

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
Industrial Arts students should be given ample opportunity to examine and work with a variety of product materials used in industry. Small individual or group projects which utilize several separate materials are encouraged. Teachers should attempt to make this unit an opportunity to stress correct nomenclature and key terminology in describing and discussing the wide variety of basic industrial materials.	Students will be given a systematic introduction to industrial materials so that they will be qualified to make sound decisions relative to: Selecting proper materials for particular products or projects. Making cost comparisons when producing the same product using high and low quality materials.	As a result of completing this unit, students should be able to: Appreciate how altering materials increases their value. Classify and describe the key features of selected industrial materials. Correctly use key terminology in describing common industrial materials.

Unit VI BASIC INDUSTRIAL MATERIALS

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit the student should be able to: Identify and discuss a variety of industrial materials. Make educated choices in selecting appropriate materials for the job at hand. Correctly lay out and cut panelling, plywood, and hardboard.	*A. Woods/wood products 1. Softwood Grading a. Select b. Shop c. Common 2. Hardwood Grading a. Firsts b. Seconds c. Selects d. Commons 3. Plywood a. Veneer manufacture b. Ply construction c. Advantages over solid wood 4. Particle Board a. Composition b. System of manufacture c. Uses and applications d. Advantages and disadvantages 5. Hardboard a. Composition b. System of manufacture c. Uses and application 6. Paper products B. Leather 1. Hides a. Curing b. Tanning c. Finishing 2. Tooling calfskin 3. Steerhide, sheepskin and suede C. Plastics 1. Polyvinyls 2. Resins 3. Fiberglas a. Plastic resin/catalyst b. Molds	Prepare display board of softwood/hardwood samples. Discuss plywood sawing and nailing Prepare samples of plywood edge molding or covering. Prepare a display showing lacing, cutting, tooling and carving leather. Cut and cement plexiglas, sand edges and polish with toothpaste.	Introduce class to wood sawing, drying and surfacing. Provide samples of various woods, lumber and plywood for class discussion. Discuss advantages, disadvantages, and industrial application of selected composition boards and papers. Discuss injection molding industrial process.	

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit the student should be able to: Prepare listings of common industrial metals and their applications.	*D. Metals 1. Ferrous types a. Cast iron b. Carbon steel c. Alloy steel d. Wrought iron 2. Non-Ferrous types a. Elements 1)Aluminum 2)Copper 3)Zinc 4)Tin 5)Lead 6)Magnesium 7)Nickel 8)Chrome 9)Mercury b. Alloys 1)Aluminum 2)Brass 3)Bronze 4)Solder 5)Magnesium 3. Properties of Metals a. Malleability b. Ductility c. Thermal conductivity d. Thermal expansion e. Magnetism f. Electrical conductivity g. Effects of cold working and annealing E. Ceramics 1. Plaster 2. Clay a. Plastic qualities b. Fired day 3. Glass (silica) 4. Portland cement a. Lime b. Silica c. Alumina d. Iron oxide	Identify metal samples and discuss physical properties of each. Groups hold a soldering competition. Prepare a collection of selected metal (objects) and discuss their properties.	Provide samples of each available metal and discuss. Supervise groups' soldering activities. Establish grading standards. Present industrial applications of various metals.	

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit the student should be able to: Compare and discuss the advantages and disadvantages of different types of industrial ceramic materials.	5. Concrete a. Mixing ratios b. Use of aggregates c. Curing d. Reinforcing 6. Ceramic properties a. Inorganic b. Hard-rigid-brittle c. Hi-voltage insulation d. Inexpensive e. Non-flammable f. Tasteless and odorless 7. Industrial applications a. Spark plugs b. Grinding stones c. Bricks and mortor d. Dentures e. Pottery and china f. Bathroom tiles	Complete a telephone survey of comparative costs of the same materials. Compare results in class. Make a mold and prepare concrete stepping stones. Bring in an example of a ceramic industrial product and discuss in class.	Introduce class to the general industrial uses of ceramics. Assign a cost survey- same materials from different vendors. Explain the principles of reinforcing rods in commerical concrete work. Show film or slides showing industrial use of various ceramic materials.	
	*F. Gases 1. Oxygen 2. Acetylene a. Welding joints b. Spark lighter c. Neutral flame 3. Industrial applications a. Fabrication MIG & TIG welding b. Welding (1) Ship building (2) Oil rig construction (3) Auto body repair c. Industrial construction d. Petroleum industry	Research the amount of heat generated in oxy-acetylene welding (6300°F). Convert to a reading in Centigrade.	Demonstrate gas welding as available equipment allows. Stress safety and eye protection.	
	*G. Liquids 1. Fuels 2. Solvents 3. Paints		Demonstrate industrial spray equipment as available.	

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit the student should be able to: Discuss the need for special safety considerations when using and storing industrial liquid materials. Use a spray can correctly.	4. Thinners 5. Primers 6. Aerosol spray cans a. Correct usage b. Safety	Participate in group exercise in correct method of cleaning paint brushes.	Demonstrate correct usage of listed industrial liquids. Stress safety and use of respiratory masks.	

UNIT TITLE VII BASIC COMBINING PROCESSES

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
The purpose of this unit is to acquaint students with the common processes and materials used by industry to mix, fasten and coat various products. Teachers should plan individual and group exercises that will allow physical combinations of materials to be accomplished. Small projects and demonstrations are highly recommended.	Students will be provided a formal introduction to basic mechanical fasteners and their use. By mixing and coating materials, their skills and experiences should improve their home projects as well as their career productivity.	As a result of learning activities in this unit, students should be able to: Differentiate between the terms, "mixture," "solution," and "suspension." Describe and discuss adhesion, cohesion, and mechanical fasteners. Relate the industrial process of combining various materials to related manufacturing processes.

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OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit students should be able to: Identify three kinds of threaded fasteners. Select the correct types of threaded fasteners for three different applications.	*A. Mechanical Fasteners 1. Threaded a. Bolts d. Screws c. Nuts	Student will sort a mixture of mechanical fasteners into categories listed. Make use of several combining processes in the making of a metal tool box. Thread end of pipe with dies.	Discussion by teacher. Prepare bulletin board showing various types of combining techniques. Demonstrate using tape and dies.	(4) P. 390 (3) P. 51 P. 334-338 (3) P. 249
Identify 7 kinds of non-threaded mechanical fasteners. Drive and set a rivet to hold two pieces of material together.	2. Non-threaded a. Nails-Staples b. Rivets c. Lacing-Strapping d. Other (1) Cotter pins (2) Retainer rings (3) Clips (4) Interference fit	Student will use a tinners rivet to combine two strips of sheet metal.	Discussion of non-threaded fasteners, showing examples of each. Demonstrate use of tinners rivet to combine two strips of sheet metal.	(4) P. 389-390 P. 391-392 (3) P. 339-340
Discuss various methods of mixing components. List at least one example of mixing in each classification.	*B. Mixing 1. Two Solids a. Ground coffee blends b. Portland cement c. Alloys 2. Two Liquids a. Motor oil and detergent b. Alcohol and water c. Viscosity	Students will mix concrete to pour stepping stones.	Discussion and demonstration of mixing cement, sand, gravel and water to form concrete. Discussion of thickness of oils, or introducing the term viscosity.	(3) P. 50 (4) P. 370-372 P. 367

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Distinguish between a suspension and a solution. State an example of two gases mixed.	3. Solid and Liquid a. Suspension b. Solution 4. Gases 5. Gas and a Liquid a. Bleach-Cl_2 & HCl b. Carbonated soda	Make a solution of water and sugar and a suspension with water and starch. Shake a soda to observe CO_2 that was dissolved.	Discussion-Demonstration Discussion on how liquid bleaches are made.	(4) P. 374-375 P. 367
List reasons for coating a product. Discuss two major types of industrial bonding. List job requirements and background for job in welding.	*C. Coating 1. Purposes a. Protect b. Decorate 2. Kinds a. Organic b. Inorganic-non metallic c. Metalic-plating *D. Bonding 1. Adhesion a. Soft soldering b. Epoxy c. Contact cement 2. Fusion a. Oxyactylene welding b. Arc welding c. Spot welding	Discussion of reasons for coating. Make stencil for spray decoration of metal tool box. Select the proper kind of coating to be used on metal tool box project. Group project work involving adhering given materials with different bonding agents. Prepare a list of safety precautions pertaining to oxyacetylene welding.	Discussions and examples presented. Demonstrate correct application of common industrial adhesives. Present film on welding and lead discussion of relevance to local industry.	(3) P. 50 (4) P. 367-368 P. 377-382 (3) P. 50-51 (4) P. 386-388 (4) P. 383-386

UNIT TITLE VIII BASIC PORTABLE POWER TOOLS

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
Most work done with stationary equipment can be duplicated with portable electric tools. Portable power tools are lightweight, inexpensive, and easily carried to the work in comparison to stationary equipment. The purpose of this unit is to introduce students to the correct and safe operation of these basic portable hand tools. Teachers should cover the (*) marked tools in detail. The others are considered optional. It is suggested that each portable power tool selected by the instructor be presented systematically and thoroughly with special attention given to: A. Complete safety precautions and regulations. B. Thorough nomenclature and related terminology. C. Fully developed and professional demonstration of each tool.	Selected portable power tools will be covered as to appropriate safety precautions and proper applications.	Through this unit, students will be able to safely and properly use each tool selected by the instructor and list major parts or components.

UNIT VIII BASIC PORTABLE POWER TOOLS

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the completion of this unit, students should be able to: Identify the main parts and different types of portable power tools. Safely use and adjust portable power tools.	*A. Portable Power Tool Safety 1. Size and h.p. rating 2. Types of accessories 3. Main parts and adjustments 4. Changing cutters *B. Drills 1. Types *C. Jig Saw 1. Type of blades 2. Type of cuts a. curve b. straight c. internal d. bevel *D. Sanders 1. Types a. Belt b. Orbital c. Disk d. Reciprocating 2. Sanding Techniques E. Circular Saw 1. Cross-Cutting 2. Ripping 3. Guides and accessories F. Router G. Buffers/Polishers H. Grinders I. Miter Box Saw J. Oxyacetylene Welding Outfit K. Spray Gun L. Battery Charger	Sign safety pledge and have parents sign consent letter. Identify main parts. Operate tools under instructor's direction.	Duplicate and issue safety pledges and consent letters for signatures. Discuss and demonstrate required tools and others. Keep accurate records of test results. File test papers in student file folders.	Text Other reference books Available films and film strips. People in the school system or community.

UNIT TITLE IX ORGANIZING AND CONTROLLING WORK

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is intended to give students a working familiarity with some of the methods industry uses to control and organize production on a functional cost-efficient basis. This unit should grant the class an opportunity to compare the efficient operating techniques of industrial and school shops.	Students should see the need for work to be organized in such a manner that only minimum time/ materials are wasted. Students should grasp the idea that sound planning is critical to good work. Each student should be convinced of the value of the theme, "A place for everything, and everything in its place."	As a result of the completing of this unit, students should be able to: Grasp the concept that, as far as industry is concerned, "time is money." Realize that the principles of organizing time, materials, and money should apply to personal as well as business pursuits.

UNIT IX ORGANIZING AND CONTROLLING WORK

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit the student should be able to: Discuss how a job applicant may make a favorable impression.	A. Corporate Organization 1. Management a. Function b. Authority 2. Labor and Production 3. Ownership by Stockholders	Role playing of various levels of the typical industrial corporation. Example: One student is a Personnel Director; another is a job applicant, etc.	Introduce the topic of general industrial organization and corporate structure.	
Describe how efficient physical operations cut costs in industry.	*B. Industrial Efficiency 1. Cuts costs 2. Saves time 3. Techniques a. Flow charts b. Organization Charts c. Research and development d. Time-motion studies e. Inventory control f. Production control	Mass production contest. Groups must fold paper correctly in a given time frame. Compare results.	Lecture on job interview techniques and procedures. Try and assign complex operation involving folded paper object. The group completing the maximum number of objects will be the most efficient.	
Relate logical tool storage with a safe shop atmosphere.	*C. Shop Efficiency in Equipment Storage 1. Color coding 2. Tool Silhouettes 3. Bins, racks, and cabinets	Examine tool storage set-up in Industrial Arts Shop. (s)		
Develop personal habits of thinking and working with efficiency-at-home as well as at work.	*D. Personal Efficiency 1. Working against the clock 2. Avoiding wasted motion 3. Planning ahead 4. Comparing procedures used with other person's procedures.	Draw a sketch of a 4' x 8' sheet of plywood and lay out given repeat patterns. Compare solutions for maximum number.	Conduct a brief tour of shop spaces; stress functional aspects of good tool storage.	

UNIT TITLE X BASIC STATIONARY POWER TOOLS

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
The purpose of this unit is to introduce the important subject of stationary power tools to Industrial Arts students in a safe and orderly manner. Certain (*) marked tools are considered satisfactory for complete student check out and operation; however, others are intended to be introduced only at the individual teacher's option. With many of the latter, a complete demonstration, with safety highlights, will suffice. A thorough exposure to these optional tools may be postponed until more detailed units in related subject areas are introduced.	The major goal of this unit is to give students enough working knowledge of major shop machinery so that they can feel confident, but respectful, toward basic stationary power tools.	As a result of learning experiences completed on selected tools in this unit, students should be able to: Describe parts for each selected power tool. Feel confident and comfortable with selected power tools. Exhibit correct and safe operating procedures for selected power tools.

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UNIT X BASIC STATIONARY POWER TOOLS

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the end of this unit students should be able to: Relate the principles of General Safety to stationary power tools. Pass written safety tests on common stationary power tools. Develop general familiarity with selected (optional) stationary power tools.	*A. Stationary power tool safety review 1. General regulations 2. Injury potential 3. Guards 4. Operator safety zones 5. Accident review *B. Demonstrations and student check outs, including specific safety instruction in: 1. The Scroll saw 2. The Drill press 3. The Bench grinder 4. The Disc/Belt sander *C. Optional instruction in the: 1. Table saw 2. Radial arm saw 3. Jointer 4. Surfacer 5. Band saw 6. Power hack saw 7. Air compressor	Make relevant Safety Poster for display. Complete basic tests on tool safety nomenclature. Complete individual/group projects as assigned. Complete notebooks, sketches, and lists of major parts.	Emphasize seriousness of safety as related to stationary power tools. Correctly demonstrate each tool. Arrange student practice and project work. Administer formal evaluations and safety tests. Optional demonstrations.	Appendix Appendix Actual shop tools Selected text references

UNIT TITLE XI MASS PRODUCTION CONCEPTS

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is designed to acquaint students of General Industrial Arts with the key concepts underlying production in U.S. industry. Whenever feasible, teachers should attempt to teach this unit by actually setting up group project work on the "assembly line" basis. Careful selection of a suitable small project to be mass produced by the class will add a high level of student interest and enthusiasm.	Students will realize the role which mass production plays in American industry. Students will develop an appreciation of principles and practices employed in jobs and occupations utilizing mass production techniques in manufacturing and industry.	After completing this unit, students should be able to: Understand and appreciate the relationships between management, production and personnel involved in American industry. Set up and actually mass produce a small product, utilizing general industrial mass production techniques.

UNIT XI MASS PRODUCTION

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit the students will be able to: Analyze a process for a product for the purpose of mass production. Identify types of company ownerships and choose an appropriate type for simulation purposes. Establish an efficient flow system for production. Modify existing tools and equipment for a mass production run. Develop efficient storage, packaging, and shipping methods. Team with others in a successful joint effort of mass producing a product.	*A. Business and Finance 1. Types of company ownership a. Proprietorship/ Partnership b. Corporation (1) Sell certificates and shares (2) Profit sharing and losses (3) Meetings of stock holders (4) Legal requirements (5) Dissolving a corporation 2. Accounting a. Capital available b. Production costs c. Sales d. Profits/Losses e. Share distribution *B. Market Research/Product selection 1. Determining Market for Products a. Utility b. Desirability/Need c. Cost Analysis 2. Product Selection *C. Product Design and Engineering 1. Sketching and designing 2. Product simplification 3. Standardization of parts 4. Working drawing 5. Pilot model/prototype a. Construction Analysis (1) Type materials (2) Operations (3) Finishing Methods (4) Modifications	Discuss, take notes, and study the types of company ownerships. Discuss and study the principles of mass production and how they relate to industry. Discuss and determine the type of company ownership that is suited for the class. Discuss, research, and select a product for mass production. Determine through discussion and sketching, the basic features of the product to be mass produced. Study and analyze mass produced items.	Discuss types of company ownership, advantages and disadvantages of each. Discuss how mass produced items will yield higher profits because of the efficient production methods utilized by U.S. industry. Discuss different types of company ownerships. Discuss with students possible products for mass production. Discuss with students the basic features of the product. Have students study and analyze mass produced items.	Modern Woodworking, Wagner (Goodheart-Wilson Publishers) *Junior Achievement Simulation World of Manufacturing McKnight & McKnight Publisher Various items known to be mass produced.

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	*D. Production Engineering 1. Tooling Up a. Machine and tool set-up and modifications b. Jigs c. Fixtures 2. Equipment Layout and Production lines a. Production line analysis b. Organization of machines, materials, and workers c. Inspection stations *E. Storage, Packaging and Shipping 1. Materials storage 2. Product storage 3. Packaging methods 4. Shipping methods F. Industrial Sales	Observe, discuss and assist with construction of the pilot model. Discuss pilot model and analyze for modifications. Analyze and discuss operations and develop a flow chart for the mass produced product selected. Discuss and develop ideas for jigs and fixtures for the production line. Production (work). Analysis and discussion of mass production techniques. Distribution of mass produced products.	Develop a working drawing for a selected product design and have the class assist and observe the construction of the pilot model or prototype. Discuss with students the pilot model and determine if modifications are needed. Analyze operations involved on pilot model, and develop with students a flow chart. Develop a production line and organize the machines, tools, and workers for best efficiency. Develop jigs and fixtures needed for production. Production (supervision). Analysis and discussion Release products for distribution.	

UNIT TITLE XII BASIC MATERIALS PROCESSING

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
The purpose of this unit is to formally introduce students to major processes employed by U.S. industry in forming, separating and conditioning common industrial materials. Teachers should attempt to cover items in all three major (*) marked topics. Whenever possible, small but challenging projects should be used to demonstrate these processes.	A major goal is to educate General Industrial Arts students in the terminology applied to standard industrial processes.	When completing this unit, students should be able to describe and understand industrial processes and related procedures. Students should develop the ability to differentiate between physical and chemical means of modifying working materials.

UNIT XII BASIC MATERIALS PROCESSING

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
As a result of completing this unit, students will be able to: List common industrial procedures for joining various materials and display familiarity with key terms.	*A. Forming Materials 1. Casting and molding a. Metals b. Plaster c. Slip clay 2. Compressing or stretching a. Forging (metals) b. Stretch forming (sheet metals) c. Thermo-forming (Plastics) d. Spinning (metals) e. Drawing f. Extruding (metals and plastics) g. Bending	Complete given project work in pouring plaster, plastic resin, or cast metal.	Present, demonstrate, and discuss sandmold casting. Directed project work. Present examples of products formed by various methods.	Film on Sand Casting Procedures (3) P. 369-374 Selected text or catalog reference
Describe technological separation processes employed in the manufacture of given industrial products, and show familiarity with key terms.	*B. Separating Materials 1. Wood Millwork a. Cutting b. Surfacing c. Joinery cuts d. Smoothing 2. Thermal Cutting a. Hot Wire b. Oxy-acetylene cutting c. Arc cutting 3. Shearing/punching 4. Machinery a. Drilling b. Turning c. Milling d. Shaping e. Grinding	Group or individual project work as directed. Complete small sheet metal project.	Introduce and assign simple projects which utilize various cutting, drilling, and smoothing operations. (*Stress terminology items.)	(3) P. 210

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	5. Cutting with abrasives a. Garnet paper b. Emery cloth c. Steel wool d. Silicon carbide paper e. Aluminum oxide cloth 6. Filing	Group activity involving correct wood sanding/metal cleaning operations.	Distribute wood samples for proper sanding.	(3) P. 359-363
Discuss internal and external changes which occur during common industrial conditioning operations, and be conversant with key terms.	*C. Conditioning Materials 1. Annealing 2. Magnetising 3. Tempering 4. Hardening 5. Case hardening 6. Chemical changing a. Catalysts b. Reactants 7. Displacement finishing a. Peening b. Planishment 8. Coloring a. Anodizing b. Bluing	Group project involving actual (or simulated) hardening or tempering of carbon steel.	Select rusty shop tools for surface conditioning. Lecture and discussion of common industrial conditioning procedures.	(3) P. 364 Selected text references, films as available (3) P. 388-9 Field trip or invited resources expert

UNIT TITLE XIII FINISHING

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit should expose General Industrial Arts students to a wide variety of finishing operations. They should understand the nature of individual materials as well as their correct application. Small projects which require two or three separate finishing operations are highly recommended.	Students should be able to describe and use various finishing products and finishing operations. They should be qualified to make logical decisions of matching given finishing materials to given projects.	Understand and apply the principles that materials may be made more beautiful, useful, and durable through finishing. Feel confident using selected brushes, solvents, paints, varnishes, spray cans, and related supplies.

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Upon completion of this unit, the student will be able to: List and describe problems encountered in cleaning, decorating, and preparing a surface for finishing. Select the appropriate finish for a given interior or exterior finishing task.	*A. Preparation 1. Sanding 2. Filing 3. Bleaching 4. Decorating 5. Removing glues and adhesives 6. Annealing 7. Pickling 8. Distressing 9. Etching *B. Finishes 1. Opaque a. Paint/enamel (1) Latex base (2) Lacquer base (3) Dyes b. Primers c. Epoxies 2. Transparent a. Shellac b. Lacquer c. Sealers d. Stains (1) Oil (2) Water (3) Spirit 3. Binding 4. Padding 5. Spotting 6. Glazing 7. Multi-color	Practice on a small piece of material. Discuss types of finishes and list application procedures. Read and follow printed instruction on containers. Apply a given finish to a project.	Lecture and demonstration of various surface preparation techniques. Lecture and demonstration of finishes. Set up a display area featuring different materials. Show and discuss film or film strip, as available.	Selected text references Selected color charts Field trip to cabinet shop, metal shop, ceramic shop, art gallery, printing shop, and/or furniture store. (3) P. 391-T23-1

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Choose and apply the correct solvent for the finishing job at hand.	*C. Solvents 1. Water 2. Mineral Spirits 3. Alcohol 4. Lacquer thinner 5. Turpentine 6. Acids	Clean finish applicator with proper solvent after use. Correctly thin finish materials.	Lecture and demonstration Stress safety involving solvents.	Text Display charts
Demonstrate the ability to change the appearance of a product by applying a suitable finish.	*D. Application 1. Brush 2. Spray 3. Dip coating 4. Wiping	Apply a finish to a fabricated product.	Lecture and demonstration	Selected text references Display charts
Differentiate supplies from materials.	*E. Supplies 1. Brushes 2. Rags 3. News print 4. Rotten stone 5. Rubbing compound 6. Polishing compound 7. Pumice stone 8. Steel wool 9. Wet/dry abrasives	List the supplies and materials required to finish a project.	Conduct a tour of the finishing area. Display selected supply items.	Shop supply and hardware catologs Newspaper ads
	*F. Materials 1. Paints/Enamels 2. Thinners and solvents 3. Fillers a. Liquid b. Paste 4. Varnish a. Satin b. Gloss 5. Tung Oil 6. Oil colors 7. Stains a. Oil b. Water c. Spirit 8. Sealers		Display selected finishing materials.	

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Compare the many types of coverings and trims applied to surfaces.	G. Surface covering and trim 1. Laminates 2. Flocking and/or felt 3. Decals and appliques 4. Vinyl, contact paper, cloth, leather, etc. 5. Moldings 6. Miscellaneous	List materials and trim found in the home.	Lecture and display of materials.	Fine furniture brochures and catalogs. Department store catalogs
Demonstrate good safety skills, attitudes, and habits while working with finishing materials and supplies.	*H. Finishing Safety 1. Ventilation 2. Storage a. Rags and solvents b. Finishing materials 3. Toxic materials a. Odors b. Irritants c. Gases 4. Eye Protection 5. Respirators 6. Fire extinguishers	Prepare safety posters. Copy safety rules in notebooks.	Introduce related safety equipment, its care and proper function.	(3) P. 395-397

UNIT TITLE XIV RELATED SUBJECT AREA(S) MATERIALS AND EQUIPMENT

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is intended to familiarize General Industrial Arts students with the applicable key materials and equipment utilized in two or three additional Industrial Arts subject areas. Teachers should stress exploratory experiences in these two or three subject areas taught within their own school. It is intended that the teacher provide exploratory experiences and knowledge in other related subject area units from the following Industrial Arts subject areas: WOODWORKING CONSTRUCTION METALS ELECTRICITY/ELECTRONICS POWER AND ENERGY POWER MECHANICS DRAFTING GRAPHIC ARTS PLASTICS RECREATIONAL CRAFTS	Students completing this unit will be able to apply the knowledge of materials, processes, equipment, and tools to their general education, as well as to further studies in selected shop subject areas.	As a result of completing this unit, students will be able to: Make educated personal choices in scheduling further related Industrial Arts unit shop courses. Be generally conversant with the nomenclature and terminology relevant to at least two other Industrial Arts unit subject areas.

UNIT XIV RELATED SUBJECT AREA(S) MATERIALS AND EQUIPMENT

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit the student should be able to: Make educated personal choices in scheduling Industrial Arts courses. List key materials, processes and equipment utilized in several separate Industrial Arts unit course offerings. Sensibly compare costs for identical item(s) prior to purchase of tools, equipment, supplies and materials.	*A. Basic portable equipment 1. Tool identification 2. Proper use 3. Safety review *B. Basic stationary equipment 1. Equipment identification. 2. Proper use 3. Safety review *C. Placing orders 1. Common tools and equipment in related areas 2. Common expendable supplies and materials *D. Comparative shopping of identical items 1. Newspaper advertising 2. Various industrial catalogs E. Supplies and storage F. Follow course of instruction per each unit subject area.	Study of related tools and equipment. Study safe use of tools and equipment. Divide into groups to prepare an order from given catalogs. Prepare a paper explaining how storage area set up may be improved. Work on projects in each appropriate unit subject area as feasible.	Conduct tour of selected related subject area classroom/shop. Demonstrate correct use of related tools and equipment. Provide newspaper and industrial catalogs. Explain the value of efficiency and order in handling and storing supplies. Supervise work activities in unit subject area as feasible.	State Department of Education course guidelines

UNIT TITLE XV RELATED SUBJECT AREA(S) PLANNING AND DESIGNING

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is intended to familiarize students with two or three additional Industrial Arts subject areas in regard to their respective planning and designing requirements. Teachers should emphasize areas taught in their own school systems. It is intended that the teacher link this (and often related-subject area units) with several of the following Industrial Arts subject areas: WOODWORKING — DRAFTING CONSTRUCTION — GRAPHIC ARTS METALS — PLASTICS ELECTRICITY/ELECTRONICS — RECREATIONAL CRAFTS POWER AND ENERGY — POWER MECHANICS	Students should be able to apply planning and designing skills to their own general education as well as to certain selected subject areas.	As a result of the learning objectives developed by this unit, students should be able to: Develop creative abilities to sketch and plan as a means of communicating with others. Build their skills in problem-solving principles. Approach the planning phase of original project development with confidence in themselves and their ability to think in logical sequencing steps.

UNIT XV RELATED SUBJECT AREA (S) PLANNING AND DESIGNING

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit, the student should be able to: Develop their creative skills and abilities to sketch and plan as a means of communicating with others.	*A. Rough and refined sketches 1. Problem identification 2. Developing possible solutions	Prepare several rough or thumbnail sketches.	Demonstrate sketching techniques, stressing line central.	
	*B. Finalizing Project Choices 1. Refinement of solutions 2. Developing drawing layouts 3. Selecting materials, colors 4. Choosing desirable shapes	Given choices of design problems, prepare a series of design sketches.	Assign design problem in related area, allowing several choices.	
	*C. Design Limitations 1. Size 2. Shape 3. Materials 4. Production Capability 5. Safety	Explain in writing their design limits.	Explain comparative shopping techniques (for materials).	
	*D. Costs and estimates 1. Unit cost concept 2. Bill of material 3. Estimating labor costs 4. Costs for multiple units	Complete a written cost estimate for producing one or several projects.		
	E. Elements of good design 1. Meets function 2. Simplicity 3. Balance 4. Harmony and Unity 5. Key feature	Bring in object or photograph which displays good design.	Discuss selected student objects or photos.	
	F. Group planning 1. Decision making a. Brainstorming b. Product selection 2. Work assignments 3. Leadership 4. Cooperation 5. Choosing materials 6. Organizing production sequence	Design through sketches and drawings, a project which results from group decisions.	Assign meaningful project suitable for group design problem.	
	*G. Working drawing 1. Samples relevant to subject areas	Study and discuss working drawings.	Present working drawings.	

UNIT TITLE XVI RELATED SUBJECT AREA(S) SAFETY REVIEW

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is directed at introducing General Industrial Arts students to specific safety considerations of several Industrial Arts subject areas taught in the local school district. Unit coverage should integrate general shop safety instruction with safety precautions in two or three other given subject areas in the following Industrial Arts course offerings: WOODWORKING CONSTRUCTION ELECTRICITY/ELECTRONICS METALS POWER AND ENERGY GRAPHIC ARTS PLASTICS DRAFTING POWER MECHANICS RECREATIONAL CRAFTS	Students will receive detailed safety instruction in preparation for work in selected subject areas. Students should be able to apply safety education to shop work as well as in personal use.	Upon completion of this unit, students should be able to: Apply general safety guidelines to specific instructional areas. Provide minor First Aid treatments to themselves and others. List common injuries (and their prevention) in several different types of shops. Conduct a basic safety inspection of a given working shop.

UNIT XVI RELATED SUBJECT AREA(S) SAFETY REVIEW

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit, the student should be able to: Apply general safety guidelines to specific Industrial Arts subject areas. Perform minor First Aid treatment for other students as well as for themselves. List common injuries and their prevention in several separate types of Industrial Arts shop courses. Conduct a rudimentary safety inspection of a given area/shop.	*A. Specific laboratory safety regulations 1. Posted regulations 2. Safety guidelines 3. Lab safety handouts/tests *B. Related safety equipment 1. Guards 2. Goggles 3. Clothing 4. Miscellaneous a. Hard hats b. Safety shoes c. Fire bottles d. Gloves C. Review of Common Accidents and their causes 1. Accident prevention 2. Accident re-enactment 3. Accident analysis *D. Basic first aid 1. Minor cuts 2. Serious bleeding 3. Objects in the eye 4. Treatment for shock 5. Broken bones 6. General CPR Techniques a. Mouth-to-mouth resuscitation b. Chest massage E. Hazardous Items 1. Flammable Liquids 2. Dust 3. Grit 4. Sharp edges, corners 5. Electrical problems F. Safety inspection procedures 1. Tool inspection a. Sharp b. Clean 2. Electrical safety hazards 3. Storage areas 4. Working areas	Review and study related subject regulations Role playing in the guise of: 1. OSHA Inspector 2. Safety Engineer 3. Injured industrial worker Simulations of shop injuries and their treatment Prepare safety wall posters displaying the theme of "Safety in the Shop." Write a short paper on safety covering two separate Industrial Arts shop courses.	Introduce class to related safety by a visit to Industrial Arts teaching shops or classrooms. Discuss the value of a positive safety attitude. Have a student "actor" simulate a common shop accident. Discuss prevention and treatment. Show appropriate safety film (s) or slides.	

UNIT TITLE XVII HOME MAINTENANCE APPLICATION

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
Most adults regularly encounter problems involving home maintenance. A major goal of the Louisiana public school system is to prepare its citizens to be effective and functional home makers. Home repair costs are often extremely expensive. Therefore, General Industrial Arts education should logically prepare students to safely execute common home repairs and to be generally aware of the respective costs involved. Teachers are encouraged to make use of realistic practice sessions and simulations of home repair challenges.	General Industrial Arts students will be provided with the fundamental knowledge and skills required to safely perform basic home repairs and upkeep. In addition, they will develop self-confidence in handling home tools and materials.	As a result of completing this unit, students will be able to: Make correct personal choices in selecting tools and materials for basic home repairs. Feel generally informed as to the current costs of common building materials and repair equipment.

UNIT XVII HOME MAINTENANCE APPLICATIONS

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Experiences and activities in this unit will enable the student to: Properly select materials for a given refinishing task. Repair broken furniture. Remove old finishes and apply new finish. Safely handle hand and electric tools at home. Select proper materials for maintaining the home. Repair a leaking faucet and a running toilet. Describe the typical home plumbing system. Correctly identify basic common roofing materials. Simulate replacing shingles. Patch roofing leaks. Safely change a defective appliance plug. List five electrical safety precautions.	*A. Refinishing furniture 1. Initial repairs 2. Paint/varnish removal 3. New finish application 4. Tools required a. Paint scraper b. Putty knife c. Varnish brush d. Steel wool *B. Home repairs 1. Plumbing a. Tools (1) Pipe wrench (2) Plumbing pliers (3) Tubing cutter (4) Flaring tool b. Supplies (1) Faucet washers (2) Nylon packing tape 2. Roofing a. Tools (1) Claw hammer (2) Hacksaw blade (3) Putty knife b. Supplies (1) Asphalt shingles (2) Roofing cement (3) Roofing nails 3. Small Appliances a. Tools (1) TV-radio screwdriver (2) Wire stripper (3) Cutting pliers b. Supplies (1) Electrical tape (2) Spare appliance plugs	Group repair work on broken furniture items. Group refinish work on repaired furniture items. Group repair work on: 1. Replacing faucet washers 2. Copper tubing cutting and flaring 3. Thread painting or packing Prepare display board of common roofing materials. Build platform covered with roofing paper and shingles. Group work in removing and replacing shingles. Remove and replace appliance plugs. Make common splices in electrical wire.	Introduce: 1. Retaining original patina 2. Correct use of paint/varnish remover 3. Proper varnishing methods 4. Correct use of wood screws Discuss typical 110V/220V house electrical system Demonstrate faucet washer replacement Diagram/discuss flushing tank ball stopper and ball float Brief on techniques for tracing roof leaks and related patching Discuss chalk line layout techniques, capping and first course shingle application Electrical safety review Brief on Underwriter's Knot Demonstrate electrical wire stripping	(1) P. 282-287 (1) P. 522-523 (1) P. 523-526 (1) P. 465-469 (13) P. 95-98 (1) P. 469-472

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Complete basic repair or replacement of screen. Cut and replace plate glass.	4. Windows and screens a. Broken glass pane b. Ripped window screen c. Glass cutting techniques and safety	Group practice in scoring and separating plate glass.	Demonstrate glass cutting and basic screen repair.	(7) P. 259 (1) P.538-542
Develop a working familiarity with various painting tasks around the house.	*C. Painting 1. Interior painting a. Brushes b. Rollers c. Latex d. Enamel 2. Exterior painting a. Surface preparation b. Priming principles (1) Wood (2) Metal c. Latex vs. Oil based paint d. Safety with ladders	Paint a panel or wall and describe steps taken. Prepare a picture board of common painting equipment.	Discuss properties of various paints. Supervise practice painting. Demonstrate the correct use of painting equipment.	(1) P. 287-288
Make appropriate selections of wall/floor covering materials and install them correctly.	D. Installing Wall Coverings 1. Types 2. Choice Factors 3. Application techniques F. Home Safety Review 1. Electrical hazards 2. Gasoline a. Explosive nature of fumes b. Proper storage 3. Stools and ladders	Compute the amount of given materials to cover a specific wall area. Survey the classroom or home for specific carpeting or tile requirements. Discuss safety discrepancies noted at home or in school.	Supervise practice sessions involving computations. Lead a discussion on common home safety discrepancies.	(1) P. 530-537

UNIT TITLE XVIII ENERGY ORIENTATION

INTRODUCTION (PURPOSE/ RATIONALE/ INTENTION)	UNIT GOAL(S)	GENERAL UNIT OBJECTIVES
This unit is included in the General Industrial Arts curriculum in order to fix student attention on the importance of energy and its consumption and conservation. Teachers should encourage students to appreciate the production cost factors which are directly related to energy utilization. Discreet requests for cost information about family utility bills may be a means of adding interest to this unit. Additionally, utility bills from both the private and public sectors may prove beneficial in conveying the importance of energy conservation.	Students will be provided with sufficient statistical data to enable them to realize the role of energy in industry and the private living sector. Students will have a means of analyzing the advantages and disadvantages of available energy sources.	Upon completion of this unit, students should be able to: Compare and contrast the various forms of energy used by industry and in the home. Develop a conservative attitude towards energy utilization. Sensibly discuss several current major energy issues on a local, statewide and national level. Develop positive attitudes towards future energy conservation.

UNIT XVIII ENERGY ORIENTATION

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
At the conclusion of this unit, student should be able to: List the various forms of energy and give examples of each form.	*A. Energy Forms 1. Heat 2. Chemical 3. Electrical 4. Mechanical	Complete a crossword puzzle or word matrix using key energy terms.	Design a crossword puzzle or word matrix.	Kansas State Power & Energy Curriculum P. 6,8,10-11
List various energy sources Compare various energy sources and list the advantages and disadvantages of each. Discuss relative availability and projected future for each common energy source.	*B. Energy Sources 1. Coal 2. Oil 3. Natural Gas 4. Nuclear Energy 5. Solar 6. Wind 7. Organic a. Wood b. Waste products 8. Geothermal 9. Muscle	Use a model windmill to demonstrate how windpower works. Use a model of a waterwheel to demonstrate how water works. Demonstrate and compare the use of muscle power with other forms of energy. Discuss various sources of muscle power and related limiting factors. Discuss various means of recycling organic wastes that would directly help alleviate energy shortages.	Construct or procure simple model windmill(s). Gather objects of varying sizes and weights for demonstrating muscle power.	(20)
Define the following terms: Btu, quad, kilowatt, kilowatt-hour. Explain / discuss each of the following energy concepts: work, power, energy, potential energy, kinetic energy, renewable resource, non-renewable resource.	*C. Energy concepts 1. Measurement a. BTU b. Quad c. Watt/Kilowatt/megawatt d. Kilowatt-hour 2. Work 3. Power 4. Energy 5. Potential Energy 6. Kinetic Energy 7. Renewable/Non-Renewable	Practice reading an electric meter.	Construct a demonstration model (of paper, cardboard, wood or on a transparency) of an electric meter measuring scale.	(21) Various

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Compare basic energy consumption figures from home with that of industry.	*D. Energy Consumption 1. Residential/commercial a. Space heating b. Air conditioning c. Water heating d. Refrigeration e. Cooking 2. Industrial Sector a. Metal processing and manufacturing b. Chemical manufacturing c. Paper manufacturing d. Stone, clay, glass and concrete manufacturing and processing e. Food production and processing 3. Transportation sector a. Freight b. Passengers	With the help of parents, prepare a chart reflecting amounts and costs of energy used at home for a given period. Compare mileage versus gasoline consumption on the family car over a given period of time.	Brief class on energy use peculiar to selected industrial applications. Conduct class discussion on energy comparison between a nuclear submarine and a commercial jet airliner.	(21) Various
List several factors which affect general transportation and energy consumption. Describe common means by which energy is transmitted.	*E. Energy Transmission 1. Electrical 2. Fluid 3. Mechanical a. Belts b. Gears c. Chains, sprockets d. Levers 4. Light a. Fiber optics b. Lasers	Prepare drawings of several examples of means of energy transmission.		

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
Make a personal commitment to try to reduce energy waste.	*F. Energy Conservation 1. Saving electricity 2. Saving natural gas 3. Saving gasoline	Discuss personal intentions to help reduce energy waste.	Discuss means of energy conservation and prepare to follow up on students' stated efforts at reducing energy consumption.	
Discuss future energy implications.	*G. Future Energy Outlook 1. Potential new sources 2. Waste conversion to useful materials 3. Will we run out of conventional energy sources?	Role playing a group of students in the year 2000.	Lead group discussion, assuming class exists in the 21st century, concerning energy problems.	

APPENDIX A

RECOMMENDED EQUIPMENT LIST

1. WOODWORKING

*A. Benches with woodworking vises
B. Drill Press - 15" minimum
C. Drill - portable electric - 3/8 inch minimum
D. Grinder - tool - 7" minimum
E. Jointer, long bed - (6" minimum recommended) or uni-plane
F. Miter box and saw
G. Sander, portable belt
H. Sander, disc - floor model
I. Sander, finishing - portable
J. Saw, band (14" minimum)
K. Saw, circle (10" minimum)
L. Saw, saber
**M. Hand tools
N. Saw, jig
***O. Wood lathe - 12"
***P. Surface planner - 18"
***Q. Router

2. METALWORKING - (Minimum of two areas - each area to have appropriate *benches with vises.)

Bench Metals

A. Anvil, 100 lb. minimum
B. Bender - rod and bar
C. Drill press - 15" minimum
D. Grinder - 7" minimum
E. Shear - rod and bar for angle, rounds, and flat stock
F. Drill - portable electric, 1/4"-3/8"
**G. Hand tools

Forging

A. Furnace - forge and heat treating
B. Anvil, 100 lb. minimum
C. Buffer, 7" minimum
**D. Hand tools
E. Safety equipment

Foundry

A. Furnace - suitable for aluminum
B. Molding bench
C. Flasks
D. Molding tools
E. Stationary abrasive belt and/or disc sander
**F. Hand tools
G. Safety equipment

Sheet Metal

A. Bench with stake plate
B. Brake - box & pan, 24" minimum
C. Shear - squaring, 24" minimum
D. Slip roll former, 24" minimum
E. Stakes, sheet metal
F. Spot welder - 1/5 KVA minimum
**G. Hand tools
H. Portable nibbler

*Quantity sufficient so as to provide a work station for each student working in this instructional area.

**Tool list on following pages.

*** Desirable

3. DRAFTING
(Instruments and equipment needed for each student - may be classroom sets.)
- A. Tables and seating
- B. Compass
- C. Divider
- D. Scale
- E. T-square and triangles or
- F. Templates
- G. Drawing surface
- ***H. Reproduction machines

4. ELECTRICITY
- *A. Work benches, counters, or surface
- B. Learning system - teacher or commercial design
- C. Volt-Ohm-millimeter - one per lab if meters are built into the electricity learning system. Otherwise, one VOM for every eight students.
- D. Power supply, variable VDC, 0-15V
- **E. Hand tools

5. POWER MECHANICS
- *A. Benches with metalworking vises
- **B. Hand tools
- C. Sufficient quantity of the following operational engines for each four students in class for the duration of disassembly and assembly of engine.
  - Four stroke cycle engine (2-3.5 H.P.)
  - Two strokes cycle engine (2-3.5 H.P.)
- D. Models (4 of 8 required)
  - Steam engine
  - Jet engine such as ramjet, pulse jet or turbo jet
  - Four stroke cycle diesel engine
  - Two stroke cycle engine
  - Four stroke cycle engine
  - Free piston engine
  - Stirling engine
  - Wankel engine
  - Diesel engine

6. INDUSTRIAL PLASTICS
- *A. Benches with woodworking vises
- B. Buffer, 7" minimum
- C. Drill press, 15" minimum
- D. Eddie heat gun
- E. Flexible shaft machine
- F. Saw, band - 14" minimum
- G. Oven
- H. Injection molding machine-1/2 oz.
- I. Vacuum forming machine-10" x 12" minimum
- **J. Hand tools
- K. Saw, circle, 10" minimum
- L. Stationary, disc and/or belt sander
- M. Strip heater
- N. Jointer, 6" minimum
- O. Router

E. Instructional system for the teaching of mechanical and fluid power. (May be a teacher designed system)

*Quantity sufficient so as to provide a work station for each student working in this instructional area.
**Tool List on following pages.

***Desirable

7. PRINTING

A. Drawing boards and "T" squares
B. Triangles
***C. Typewriter, carbon ribbon, (IBM selectric type machine)
***D. Vertical and/or horizontal camera, 13" x 15" maximum film size
E. Film process sink without temperature control
F. Plate maker, 17" x 22" minimum plate, table model for pre-sensitized plates
G. Light table, 18" x 20" glass area minimum
H. Table top offset duplicator, 10" x 15" press size, friction fed
I. Developing trays, 11" x 14" and 8" x 10"
J. Safelight, red, 1A
K. Hand operated platen press, 10" x 15"
L. Chase for press
M. Quions and key
N. Composing stick
O. Imposing table (stone) complete with furniture and galleys, 27" x 39" table and chase rack
P. Lead and rule cutter, hand operated
Q. California job case cabinets, single section to accommodate 12 full sized drawers
R. Silk screen frames, assorted sizes
S. Squeegees
T. Paper cutter, 17 3/4" minimum cutting width, hand operated
U. Proof press, minimum 12" x 18", table model
V. Hand tools and accessories

8. PHOTOGRAPHY

A. Enlarger with 0-60 second timer, condenser type, negative size up to 2 1/4", with 50 mm and 75 mm lens.
B. Developing trays
C. Cameras
. 35 mm
. 2 1/4" twin lens reflex
. instamatic type camera as needed for student use.
D. Dryer, print, quick heating to handle up to 8" x 10" print if necessary for the type print paper used.
E. Developing sinks
F. Daylight developing tanks with stainless steel reels
G. Safelights
H. Print washing tank/tray
I. Work surfaces
J. Timer, 0-60 minute
K. Film dryer, reel type
L. Paper cutter
M. Wall clock, fluorescent dial
N. Easels, four size print in one
O. Accessories

9. CERAMICS

A. Appropriate work benches
B. Box, clay storage, metal
C. Cabinet, damp proof
D. Kiln, ceramics, 2000° minimum, with safety cut-off
E. Wheel, pottery
F. Wedging board
**G. Hand tools

10. JEWELRY

A. Benches
B. Buffer, 7" minimum
C. Kiln, enameling
D. Centrufugal and/or vacuum Casting machine, extended arm complete with accessories
E. Soldering torch and tank
F. Soldering bench, fire brick
**G. Hand tools
H. High temperature torch

**Tool List on following pages.
***Desirable

11. TEXTILES

A. Looms, table 12" minimum width
*B. Benches or tables
C. Warping board
**D. Hand tools

12. LEATHERWORKING

*A. Work surface
**B. Hand tools - assorted

RECOMMENDED EQUIPMENT LIST FOR INTRODUCTORY CONSTRUCTION TECHNOLOGY

*A. Benches with woodworking vises
B. Cement trough or wheel barrow
C. Drill, portable electric
D. Miter box and saw
E. Saw, band - 14" minimum
F. Saw, saber
G. Saw, portable electric hand
H. Saw, radial arm - 10" minimum
I. Tool cart
**J. Hand tools
K. Soldering gun
L. Pipe vise
M. Bar-folder, 24" minimum
N. Slip-roll, 24" minimum
O. Torch, propane

RECOMMENDED EQUIPMENT LIST FOR INTRODUCTORY MANUFACTURING TECHNOLOGY

*A. Benches with vises
B. Sander, belt or disc, floor model
C. Drill press - 15" minimum
D. Drill, portable electric
E. Saw band - 14" minimum
F. Saw, circle - 10" minimum
G. Bar folder, 24" minimum
H. Box and pan brake, 24" minimum
I. Shear, squaring, 24" minimum
J. Slip roll former, 24" minimum
K. Sander, finishing
**L. Hand tools
M. Jointer, 6" minimum

*Quantity sufficient so as to provide a work station for each student working in this instructional area.

**Tool list on following pages.

CONSTRUCTION INDUSTRIES HAND TOOL LIST

DESCRIPTION
Trowel - Finishing 4" x 14" Aluminum
Floats - Rubber 4" x 9 1/2"
Trowel, Cement 4 1/2" x 10"
Trowel, Patching 1 3/4" x 5 1/2"
Glass Cutters
Glass Cutter - Circle
Hammer - Bricklaying 16 oz. 7" long
Chisel - Bricklaying, 4" long 5/8 " single bevel
Trowel - Painting 2 3/4" x 5 1/2"
Trowel - Brick, 5" x 10 1/2"
Rubbing Brick, 6" x 3"
Knife - Taping, 3 1/2" x 11"
Corner Taping Tool
Mud Pan Stainless 14"
Chisel Set 1/4 through 1 1/4"
Brace 8"
Bits - Auger Set #4 thru #16
Bit - Expansion #2
Saw - Rip 26"
Saw - Cross Cut 26"
Saw - Compass 12"
Saw - Hack 12"
Squares - Combination
Bevel - T, 8" sliding
Steel tape - 50'
Squares - Framing 24"
Wrench - Adjustable 8"

DESCRIPTION
Wrench - Adjustable 12"
Wrench - Pipe 10" aluminum
Set - Nail 1/32", 2/32", 3/32"
Hammers - Claw
Screwdriver Set 7 pcs.
Knife - Putty 6"
Knife - Utility 6" Adjustable
Plane - Black 6 "
Plane - Jack 14"
Pliers - Combination 6"
Pliers - Side Cutter 7"
Level, Aluminum 24"
Chalk Line
Plumb Bob
Brush, Wire
Mallet, Rubber 20 oz.
Hose - 50' soft, w/nozzle
Hoe - two-hole 5 1/2' handle 10" blade
Shovel, Round point
Shovel, Square
Saw Horse Bracket (Pair)
Rake - Steel
Wheelbarrow
Scraper - Wall 4"
Edger - Curved 3" x 6"
Float - Redwood 12" x 5"
Groover- 3" x 6 "

CRAFTS HAND TOOL LIST

DESCRIPTION

Straight Gouges 1/4"
Straight Gouges 3/8"
V Parting Tools 1/4"
Brush - Utility 8"
Carving Knives 7" Long

ART METAL

American Standard Wire Gauge
Awl - Scratch 6"
Dividers 6"
Rule, Steel 24"
Combination Snips 7"
Planishing Hammer
Anvil Base 4" High

COPPER ENAMELING

Set Swiss Needle Files
File Card
Tweezers
Fork, Enameling 16 1/2"

LEATHER

Shears - All purpose
Knives - Utility, Adjustable
Draw Gauge
Snap - All Tool Set
Slicker, Circle Edge
Divider - Wing 6"
Brush, Utility 8"
Mallet - Rawhide 6 oz.
Stamps, Alphabet 1"

DESCRIPTION

Hard Arkansas Bench Stone
India Bench Stone Combination
Hard Arkansas Slip Stones
India Carving Tool Slips
Hold Down Clamps

ART METAL

Raising Hammer
Forming Hammer
Mallets, Wood
Mallets, Rawhide
Square Anvil Head
Tablespoon Anvil Head
Dome Anvil Head
Valley Anvil Head
Slope Anvil Head

COPPER ENAMELING

Spatula
Rack, Enameling Screen 3/4"
Shear, Jewelers
Saw, Jewelers Frame

LEATHER

Stamps, Alphabet 1/2"
Rules, Wood 12"
Rules, Wood 24"
Swivel Cutters
Snap Setter
Rotary Punch
Bag Punch 1/2" & 1"
Spacer
Cement Container

CRAFTS HAND TOOL LIST

THONGING CHISELS	THONGING CHISELS
1/8" 1 slit	Lacing Pliers
1/8" 3 slit	Creaser, Size 1
3/32" 1 slit	Creaser, Size 5
3/32" 3 slit	Beveler, Size 2
Lacing Fid	Beveler, Size 4
MODELING TOOLS	**MODELING TOOLS**
Deer Foot Modeler	Tracing
BEVELERS	**BEVELERS**
B935	B200
CAMOUFLAGE	**CAMOUFLAGE**
C428	C709
PEAR SHADERS	**PEAR SHADERS**
P 972	P 208
STAMPING TOOLS	**STAMPING TOOLS**
J787	Y659
J786	Y658
S866	Y659
D617	Y648
F990	S347
C431	W965
L515	Y654
L516	Y653
W532	P368
W531	V707
	Z785
SEEDERS	**VIENERS**
S706	V406
MULEFOOT	**FLOWERS**
U858	W531
	LEAVES
	L953
	L954

DRAFTING HAND TOOL LIST

DESCRIPTION	DESCRIPTION
Drafting Machine, Standard	Pencil Sharpener, Draftsman
T Square, 24"	Protractors, 6" plastic
Triangles, 30° - 60°	Lettering Triangles
Triangles, 45°	Irregular Curves
Scales, Architect 12"	Erasing Shields
Scales, Engineer 12"	Lettering Set
	Drawing Sets, Big Bow

ELECTRICITY/ELECTRONICS HAND TOOL LIST

DESCRIPTION	DESCRIPTION
Brush, Utility 8"	Saw, Hack 12"
Awl, Scratch 6"	Square, Combination 12"
Pliers, Needle Nose	Clamps, Spring 2 3/4"
Pliers, Combination 6"	Rivetool Kit - Pop
Pliers, Side Cutting	#5 Metal Punch Set
Pliers, Standard Diagonal	Heat Sinks, heavy duty
Plier, Vise Grip 6"	Crimping tools
Screwdriver, Rubber Grip 6"	Wire Stripper
Screwdriver Set, 7 pc. including Phillips	Low Voltage Tester
Nut Driver Set	Ne-O-Lite Tester
Rules, Steel 12"	File Card
Punch, Center	Files, Half-Round Smooth 8"
	Files, Half-Round 2 nd Cut 8"
	File Handles #2

GRAPHICS HAND TOOL LIST

DESCRIPTION	DESCRIPTION
Paper Cutter 24"	Rule - 48" Steel
Shears - Trimming 7"	Brayer - 2 1/2"
Rules - 24" Steel	Brayer - 3 1/2"
Rules - 12" Steel	Benzine Cans - Quart Size

COLD METALS HAND TOOL LIST

DESCRIPTION
Set Needle Files
File Cards 6"
File - Mill Smooth 10"
File - Mill 2nd Cut 10"
File - Mill Bastard 10"
File - Half Round Smooth 10"
File - Half Round 2nd Cut 10"
File - Round 2nd Cut 10"
File Handles #3
Awl - Scratch 6"
Brush - Wire 6"
Bevel - Sliding T 6"
Rule - Metal 12"
Rule - Metal 24"
Square - Steel 24"
Square - Tri 6"
Square - Combination 12"
Set-Screwdriver 7 pc. including Phillips
Clamps - "C" 1 1/4"
Clamps - "C" 2"
Clamps - "C" 4"
Clamps -Vice Grip C Type 6"
Clamps - Welding Vise Grip
Wrench - Adjustable 8"
Wrench - Adjustable 10"
Wrench - Adjustable 12"
Wrench - Pipe 12" Aluminum
Vise - Pipe 2 1/4"
Tap and Die Set

DESCRIPTION
Drill set - Twist 1/16" through 1/2" by 64th
Counter Sink
Knife -Putty
Saw - Hack 12"
Nippers - End cutting 8"
Pliers - Combination 6"
Pliers - Side Cutting 6"
Dividers - 6"
Tap and Drill Gauge
U. S. Standard Gauge
American Standard Wire Gauge
Center Gauge
Screw Pitch Gauge
Protractor
Set Center Punches
Set Drive Punches
Brush - Utility 8"
Hammer - Ball Peen 12 oz.
Hammer - Riveting 12 oz.
Hammer - Tinners Setting 12 oz.
Mallet - Plastic 10 oz.
Mallet - Rawhide 2"
Groover, Hand #0
Groover, Hand #2
Groover, Hand #4
Rivet Set #5
Rivet Set #6
Rivet Set #7
Metal Punch #5
Handy seamer
Snips - Tin 3" Cut
Snips - Circular 7"
Snips - Aviation (M1 WISS)
Snips - Aviation (M2 WISS)

HOT METALS TOOL LIST

DESCRIPTION
Bench Rammer
Bellows - 10"
Foundry Riddle - 8" Mesh
Bulb Sponge 8 oz.
Shovel - square point
Brass Sprue Cutter
Spoon and Gate Cutter
Aluminum Foundry Flasks 8" x 10"
Molders Asbestos, Aprons, Leggings and Sleeves
Melting Ladle
Asbestos Gloves
#6 Ingot Mold
Anvil
Anvil Stand

DESCRIPTION
Blacksmith Handhammer 40 oz.
Pick up Tongs 24"
Flip Front Fiberglas Welding Helmets
Welding Vise Grips
Morsite Goggles
Sparklighters
Tip Cleaners
Pair Welders Gloves
Wire Brush
Chipping Hammers
Brush - Utility 8"
Face Shields 8" x 10"
Pair Soldering Coppers
Crucibles - #10 Graphite

POWER MECHANICS HAND TOOL LIST

DESCRIPTION
Wrench - Torque In #0-200
Wrench - Torque Ft #0-50
Feeler Gauge Size .001- .035
Feeler Gauge Metric
Compression Gauge
File - 8" Three Square
File - 10" Half Round
File - 10" Flat
File Card
File Handles #3
Cylinder Hone - 3 1/2"
Easy Outs
Hand Valve Grinder
Hand Seat Attachment-Grinder
Ring Expander
Ring Compressor
Tap and Die - Metric
Valve Cup
Punch - Pin 8/32"
Mallet - Plastic 10 oz.
Mallet - Rubber
Mallet - Tinners, Wood 3" x 6"
Pliers - 7 1/2" Locking Wrench
Nippers - 7" End Cutting
Clamp - C 4"
Oil Cans

DESCRIPTION
Gas Can - 2 gal.
10 Gallon oily rag waste can
Flywheel Holder - Briggs
Flywheel Puller - Briggs
Brush - Utility 8"
Brush - Wire
Screwdriver Set 7 pcs. including Phillips
Putty Knives
Pliers - 7" Channel Lock
Pliers - 6" Needle Nose
Pliers - 6" Combination
Wrench Set - Allen
Wrench Set - open/box end combination 1/8" through 1 1/4"
Wrench - Adjustable 8"
Wrench - Adjustable 10"
Wrench - Clutch
Wrench set - Metric combination 10 pc 6MM - 19 MM
Socket Set - Metric 3/8" Drive
Socket Set - 3/8" Drive 1/4" through 1"
Nut Driver Set 7 pcs.
Punch - Hand 1/4"
Punch - Hand 1/8"
Punch - Pin 4/32"

PLASTICS HAND TOOL LIST

DESCRIPTION
Screwdriver Set, 7 pcs. including Phillips
Pliers - Combination 6"
Brayer 4"
Spring Clamps
Triangle 30° - 60°
Triangle 45°
Awl - Scratch 6"
Bevel, Sliding T
Dividers - Swing 6"
File Flat 10"
File - Round 10"
File - Card 4"
Hammer - Claw 1002, 13 oz.
Knives - Putty

DESCRIPTION
Mallet - Rawhide 3" dia.
Pliers - Vise Grip 6" clamp "C"
Punch - Revolving with replaceable punch tubes
Rule - Steel 24"
Rule - Steel 12"
Saw - Dovetail 10"
Saw - Back 12"
Saw - Coping
Scissors 6"
Snips, Tin, 12"
Square - Steel 24"
Square - Tri 6"
Wrench, Adjustable 10"
Wrench, Adjustable 8"

WOOD HAND TOOL LIST

DESCRIPTION

Awl, Scratch 6"
Bevel-T, 8" sliding
Gauge, Marking
Set, Auger Bits
  #4 through #16
Bit, Expansion #2
Braces 8"
Brushes - Utility 8"
Router Bit Set
  (Carbide when possible)
  Straight 1/4" & 1/2"
  V Groove
  Bead
  Corner Round
  Core Box 1/4"
  Cove
  Veining
Chisel 1/4", 3/8",1/2", 5/16", 3/4",
  1", 1 1/4"
Cord - Estension 25 feet
Knife - Putty
Knife - Utility 6"
  adjustable
Level - 24' Steel
Mallet _ Wood 2 1/4" Dia.
Planes - Block 6"
Planes - Smooth 9"
Planes - Jack 14"
Rules 24" Steel
Rules 12" Steel
Squares - Tri 8"
Squares - Combination
  (no level 12")
Squares - Framing 12" steel
Framing - Squares 24" steel
Screwdriver Set 7 pc. min. inc.
  Phillips
Scrapers - Hand 2 1/2"
Gun, Staple
Cutter, 7" Diagonal
Pliers, Slip Joint 6"
Countersink
Stones, Silicone carbide combination
  6 x 2 x 1 size

DESCRIPTION

Stone Slip
Drill - Multi Spur
  1/2", 9/16", 5/8", 11/16", 3/4", 13/16",
  7/8", 15/16", 1", 1 1/8", 1 1/4", 1 3/8",
  1 1/2", 1 5/8", 1 3/4", 1 7/8", 2"
Drill Set - Twist 1/16" through 1/2" by 64th
Dowel Jig Model A
Dowel Center Kit #888
Cutter - Plug #1523 3/8" (Stanley)
Cutter - Plug #1523 1/2" (Stanley)
Cutter - Plug #1523 5/8" (Stanley)
Cutter - Circle
Clamp - Corner
Clamp - Pony Band
Clamp - 1 Bar #7024 Jorgensen
Clamp - 1 Bar #7030 Jorgensen
Clamp - 1 Bar #7036 Jorgensen
Clamps, Spring
Hand Screws - 4 1/2"
Hand Screws - 6"
Hand Screws - 8 1/4"
Files - Surform 10"
Files - Surform 10" Round
Files, Rasp 10" Half Round
Files, Rasp 10" Round
Files, Half-Round 10"
Files, Round 2nd Cut 10"
File handles #3
File Cards 4"
Hammer - Upholsterers' 5 1/2" 7 oz.
Hammers - Claw 13 oz.
Set-Nail
Saw - Hack Adjustable
Saw -Rip 26", 5 1/2 point
Saw - Crosscut 26" 10 pt.
Saw -Back 14"
Saw - Coping 6 3/4"
Saw - Dovetail 10"
Saw - Compass 12"
Stops-Bench 1" x 2 1/4", 2" long
Screw-Mate Set
Wrench - Adjustable 12"
Wrench - Adjustable 10"

WOODS HAND TOOL LIST

DESCRIPTION
Wrench - Adjustable 8"
Wrench - Pipe 10" Aluminum
Calipers 6" outside
Calipers 6" inside
Dividers 6"
Sets Wood Turning Tools
Face Plate 6"

DESCRIPTION
Face Plate 3"
Knockout Bar
Screw Center (Small Work)
Wood Turning Duplicator
Hand Wheel 5" Diameter
Rest, Tool 12" at 90°

THE TECHNOLOGICAL TEAM

Technology has become a team effort involving the scientist, engineer, technologist, technician, and craftsman. A project may include mechanical design, an advanced electronics system, a structure, and chemical processes, and therefore it may require many engineers,technologists, technicians, and craftsmen to complete the design. This changing complexion of industrial technology requires that engineering teams function as a composite unit. The members of the technological team are listed below.

The Scientist. The scientist is primarily a researcher who is seeking to establish new theories and principles through experimentation and testing.

The Engineer.-The engineer's training in areas of science and mathematics, in addition to industrial processes, prepares him to apply the basic principles discovered by the scientist to practical problems. He is concerned with the conversion of raw materials and power sources into needed products and services. The emphasis on practical application of principles distinguishes the engineer from the scientist.

The Technologist. The technologist is a technically trained person who assists the engineer at a semi-professional level slightly below the engineer and above the level of the technician. While the engineer is concerned with the application of theoretical concepts, the technologist is more concerned with the application of theoretical concepts, the technologist is more concerned with routine, practical aspects of engineering whether at the planning or production stage. Several technologists working with an engineer will greatly increase the engineer's capability to perform his job, since he will be relieved of many duties by the technologist. Also, the technologist

can coordinate the activities of several technicians, thereby sharing supervisory responsibility with the engineer. The technologist usually has a four-year engineering technology background at the college level.

The Technician. The technician is a technically trained individual who assists the engineer and technologist at a technical level below the technologist. His work may vary from conducting routine laboratory experiments to the supervision of craftsmen involved in manufacturing or construction. In general, the technician works as a liaison between the technologist and the craftsman. The technician must exercise a degree of judgment and imagination in his work and assume supervisory responsibilities beyond those required of the craftsman. He is usually required to have a two-year technical-training background beyond the high-school level to be qualified for his assignment.

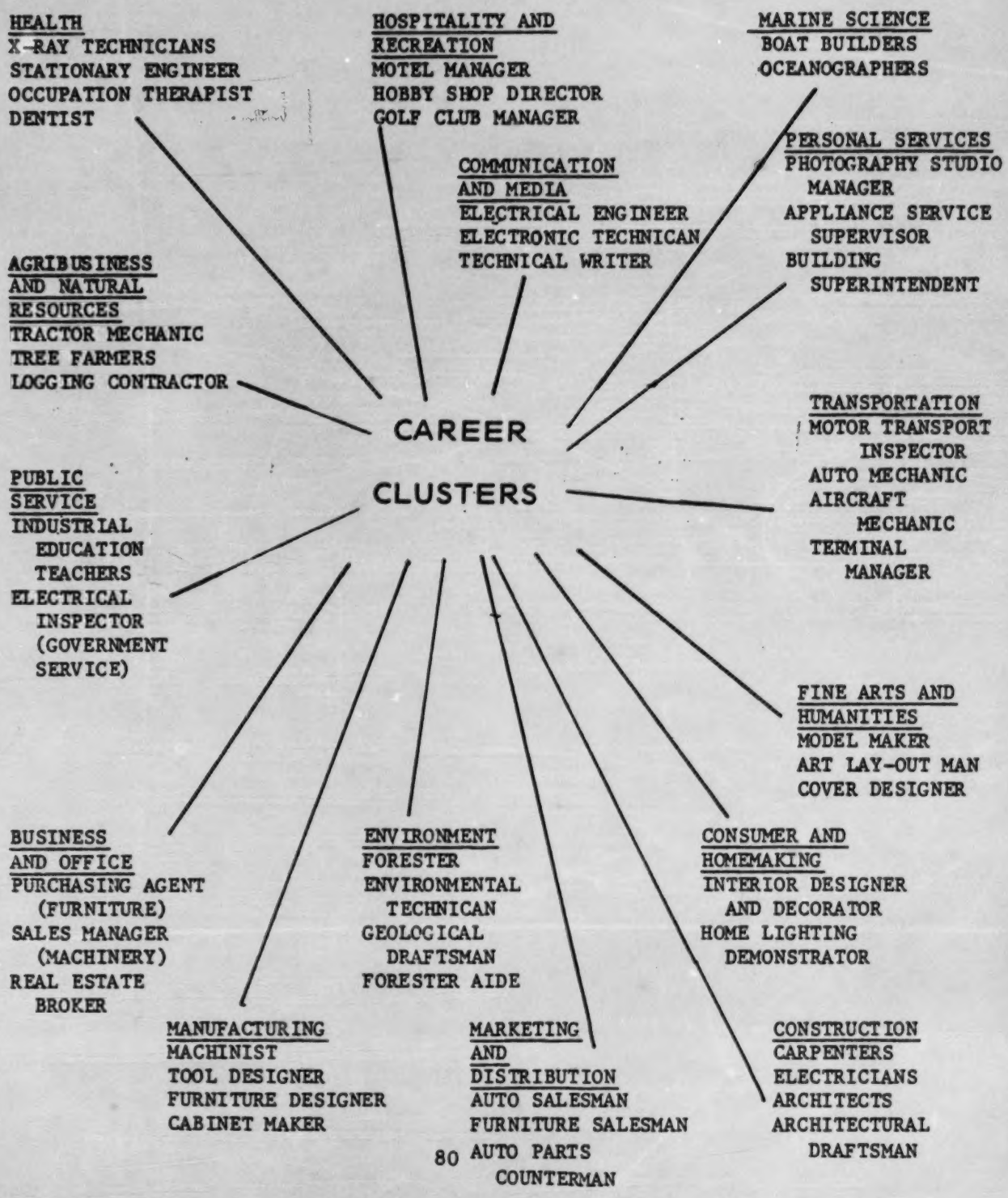
The Craftsman. The craftsman is vital member of the engineering team since he must see that the engineering design is implemented by producing it according to the specifications of the engineer. He may be a machinist who fabricates the various components of the product or an electrical craftsman who assembles electrical components. Craftsmen are no less important than other members of the team since they supply a technical skill that cannot be provided by the engineer or the technician. The ability to produce a given part in accordance with design specifications is as necessary as the act of designing the part. Craftsmen include electricians, welders, machinists, fabricators, craftsmen, and many other types.

The Designer. The designer is that individual who has special talents for creating solutions to technological problems. The designer may be an engineer,

an inventor, or a person who has special talents for devising creative solutions, even though he may not have an engineering background. This is often the case in young areas of technology where little precedent has been established by previous experience.

15 CAREER CLUSTERS

Typical careers you can learn about in Industrial Education. There are over 22,000 different occupations and many, even in clusters such as health or business and office, require know-how that you can learn by using tools, materials, and processes.



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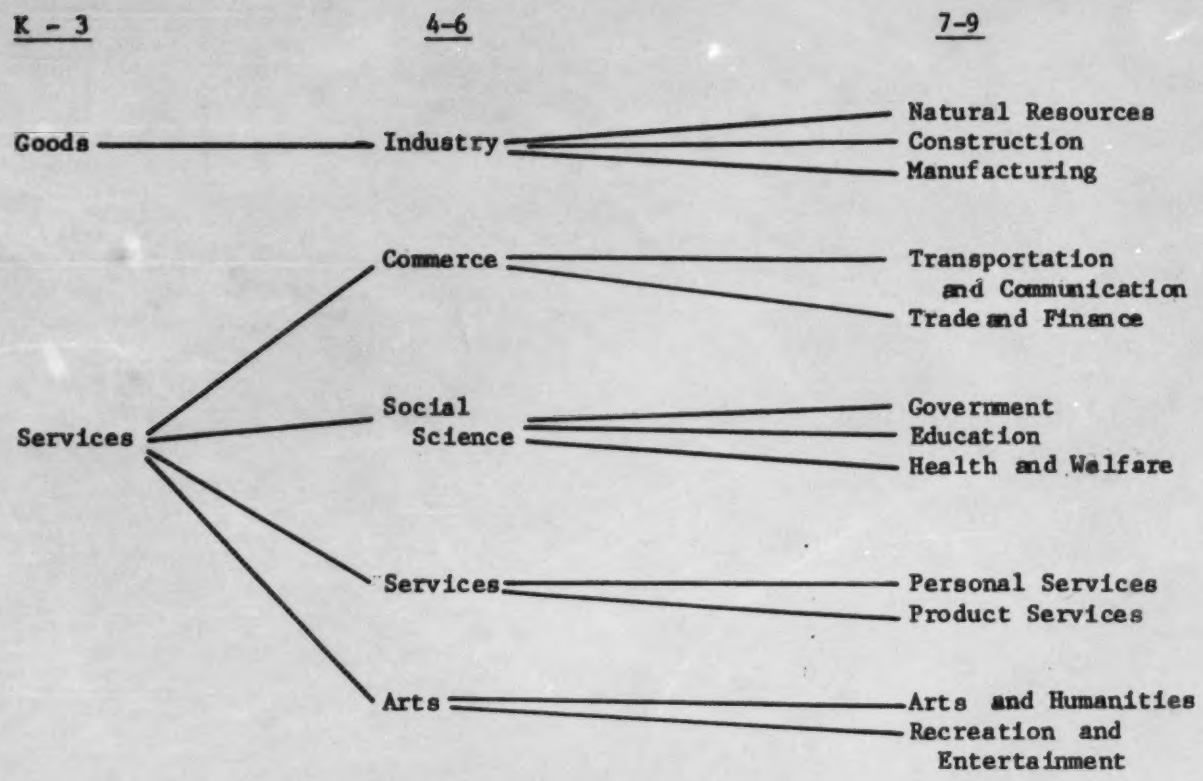
CAREER CLUSTERS



JOB CLUSTERS

1. Construction Occupations Cluster

   a. Asbestos and Insulating workers
   b. Bricklayers
   c. Carpenters
   d. Electricians
   e. Cement masons (cement and concrete finishers)
   f. Marble setters, tile setters, and terrazzo workers
   g. Operating engineers (construction machinery operators)
   h. Painters and paperhangers
   i. Plasterers
   j. Plumbers and pipefitters
   k. Roofers
   l. Structural, ornamental, and reinforcing-iron workers

2. Manufacturing Occupations Cluster

   a. Aircraft, missile, and spacecraft manufacturing
   b. Aluminum industry
   c. Baking industry
   d. Electronics manufacturing
   e. Industrial chemical industry
   f. Paper and allied products industries
   g. Petroleum refining

3. Transportation Occupations Cluster

   a. Civil aviation
   b. Merchant Marine occupation
   c. Railroads
   d. Trucking industry

4. Agribusiness and Natural Resources Occupations Cluster

   a. Conservation
   b. Ecology
   c. Electric power industry
   d. Farming, dairying
   e. Forestry
   f. Machinery (farm equipment)
   g. Mining
   h. Natural gas
   i. Petroleum

5. Marine Science Occupations Cluster

   a. Fisheries development
   b. Forecasting weather
   c. National defense
   d. Plant and animal life

6. Environmental Occupations Cluster

   a. Conservation
   b. Ecology

7. Business and Office Occupations Cluster

   a. Accounting
   b. Advertising workers
   c. Business law
   d. Marketing research
   e. Office workers
   f. Personnel workers
   g. Public relations workers

8. Marketing and Distribution Occupations Cluster

   a. Marketing research
   b. Wholesale and Retail Distribution
   c. Trade

9. Communications and Media Occupations Cluster

   a. Newspapers - printing and writing
   b. Radio
   c. Technology
   d. Television

10. Hospitality and Recreation Occupations Cluster

   a. Camps
   b. Hospitals
   c. Indoor recreation centers
   d. Industry
   e. Playgrounds

11. Personal Service Occupations Clusters

   a. Barbers
   b. Building custodians
   c. Cooks and chefs
   d. Cosmetologists
   e. Firefighters

f. Guards and watchmen
g. Hospital attendants
h. Models
i. Police officers
j. Private household workers
k. Social services workers

12. Public Services Occupations Cluster

a. Civil service employees
b. Librarians
c. Nutritionists
d. Public Health nurses
e. Public relations workers
f. Public Utilities
g. Sanitarians

13. Health Occupations Cluster

a. Chiropractor
b. Dental hygienist
c. Dentists
d. Dietician
e. Hospital administrator
f. Medical technologists
g. Nurses
h. Optometrist
i. Osteopathic physician
j. Pharmacists
k. Physicians
l. Veterinarian
m. X-ray technician

14. Consumer and Homemaking Occupations Cluster

a. Cooperative Extension Service
b. Communications
c. Department stores
d. Federal Government - U.S. Dept. of Agriculture
e. Financial institutions
f. Food manufacturers
g. Private business
h. Research
i. Social Welfare
j. Teacher

15. Fine Arts and Humanities Occupations Cluster

a. Commercial artists
b. Industrial designers

c. Interior designers and decorators
d. Performing artists
e. Social scientists
f. Teaching

Historical Outlook:

Certainly one of the major factors which has given America its vitality and strength has been the refusal of its people to think that just because something had always been done a certain way that it had to continue to be done that way.

From the very beginning, people in this new land seemed to have a unique combination of industry, top-fight science, and old-fashioned courage, with the attitude of optimistic belief that any problem could be solved.

Back in the early days when the great American consumer wanted something, he wanted it quickly, in huge quantities, and at low cost. First, it was nails to help meet the housing shortage that followed the Revolution. Returning veterans found hand made nails bringing very fancy prices, but nails had always been made by hand. So, in 1795, a man named Perkins solved the problem with a machine that made 60,000 nails a week. Then it was muskets to fight the War of 1812. There were not nearly enough gunsmiths to fill the sudden demand. Eli Whitney devised machines to make the parts separately, in lots of 10,000, then brought them together to form the whole gun--lock, stock, and barrel, which is where that phrase comes from.

Next it was pins. Back in the early days, pins cost as much as twenty-five cants apiece and were so rare that housewives used them as a form of barter, or pin money--another American phrase. So, a pin-making machine was invented and everybody could afford pins. Then it was clocks. At that time, clocks were available

only to the very wealthy. Every clock on earth was hand made. A production genius named Eli Terry built 500 of them at the same time, of standard design to sell at a low price. With his partner, a man named Seth Thomas, he created a new industry based on mass production and distribution. Soon every home in the country had a clock.

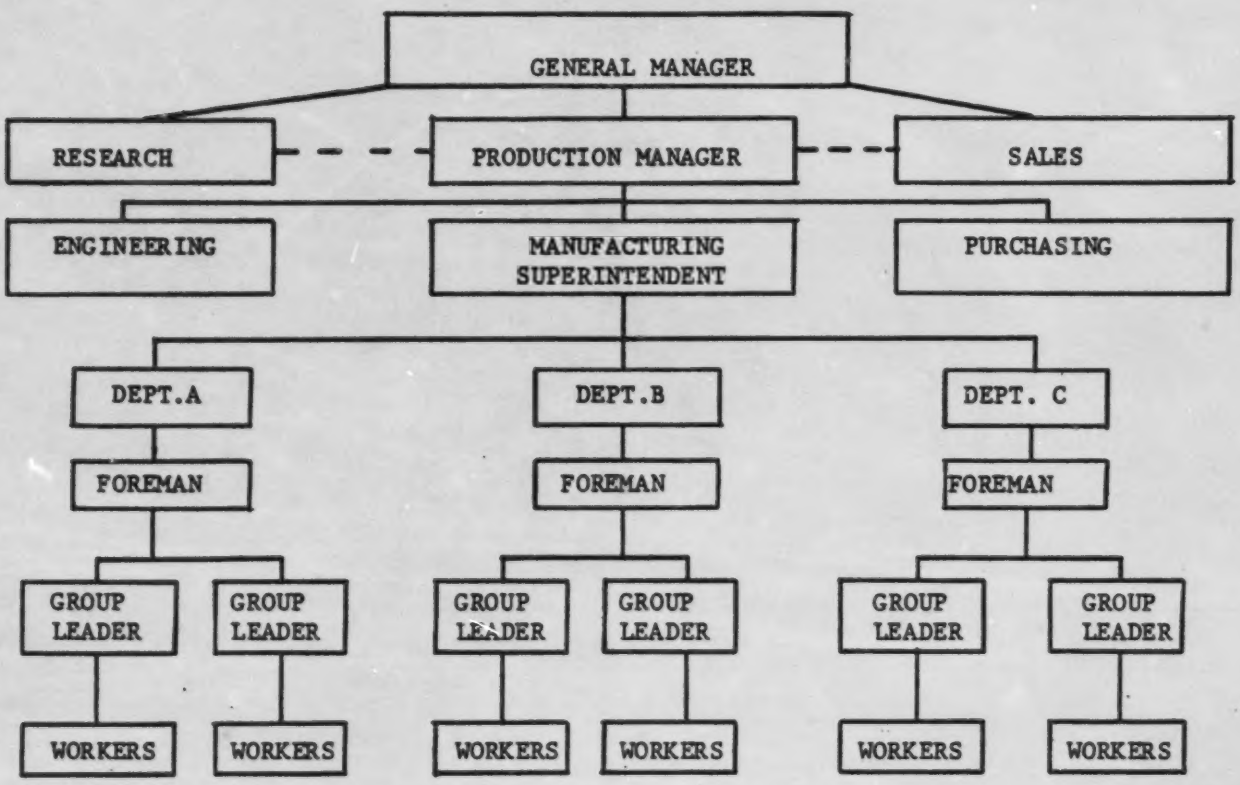
And right about here the American salesman was born. Along with clocks, pins and nails, and pots and pans were loaded onto a wagon and the Yankee peddler went from settlement to settlement selling his wares. When he arrived at a farm or community, it was practically declared a holiday. And then he added hats, clothing, soap, farm equipment and furniture.

And finally a man came along to do for the horseless carriage what others had done for nails, pins, clocks, and pots and pans. Henry Ford learned to mass produce cars and others followed suit.

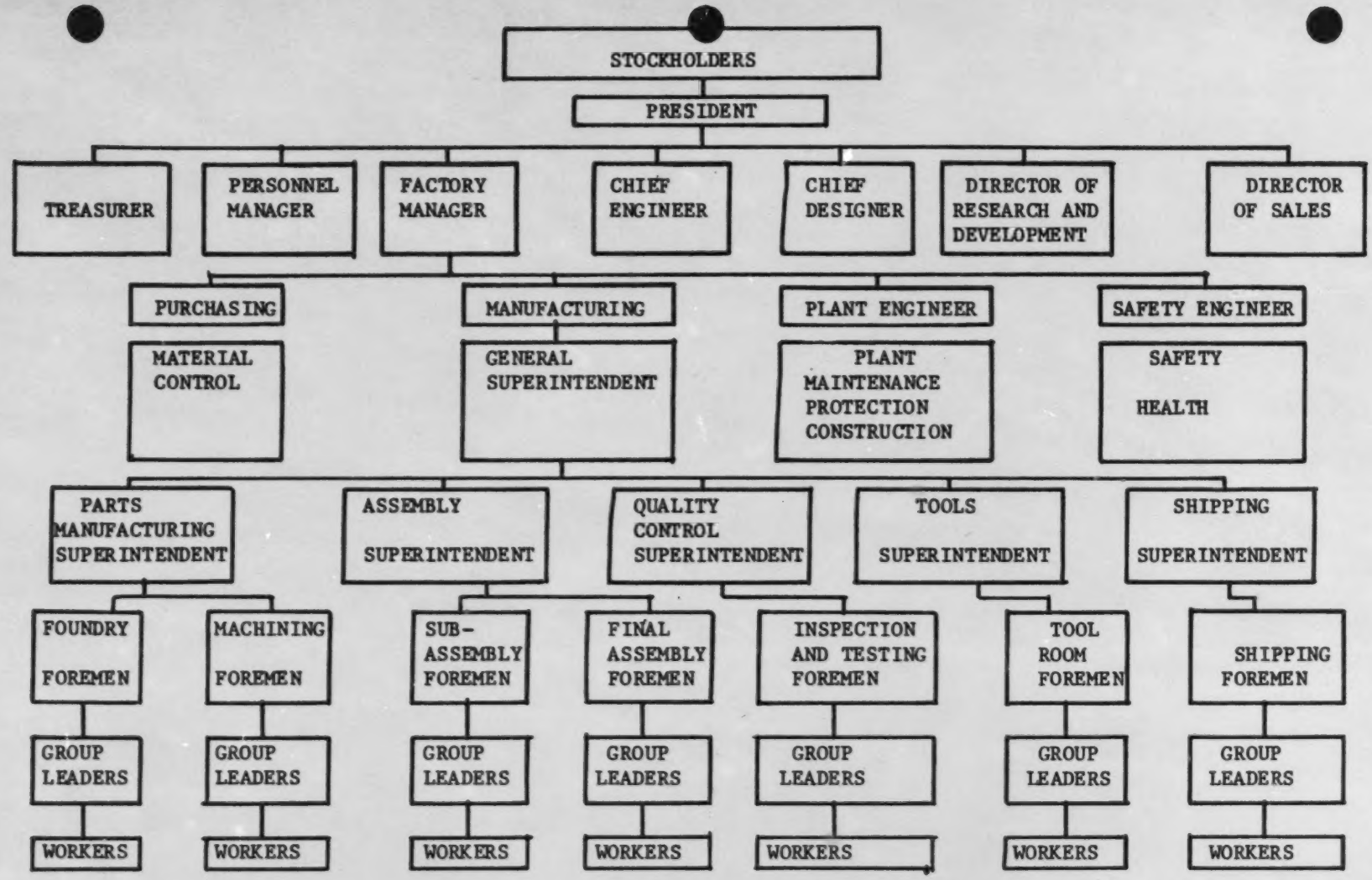
Whenever there has been a need, it seems as though an American has come along with the way and means of making it faster, in quantity, and for less money.* This is what industry is about. This is our technological culture in which we live.

*Earl Nightingale

DIVISIONAL ORGANIZATION CHART



This is a sample organization chart of a division of a larger corporation.



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PERSONNEL ORGANIZATION FLOW CHART

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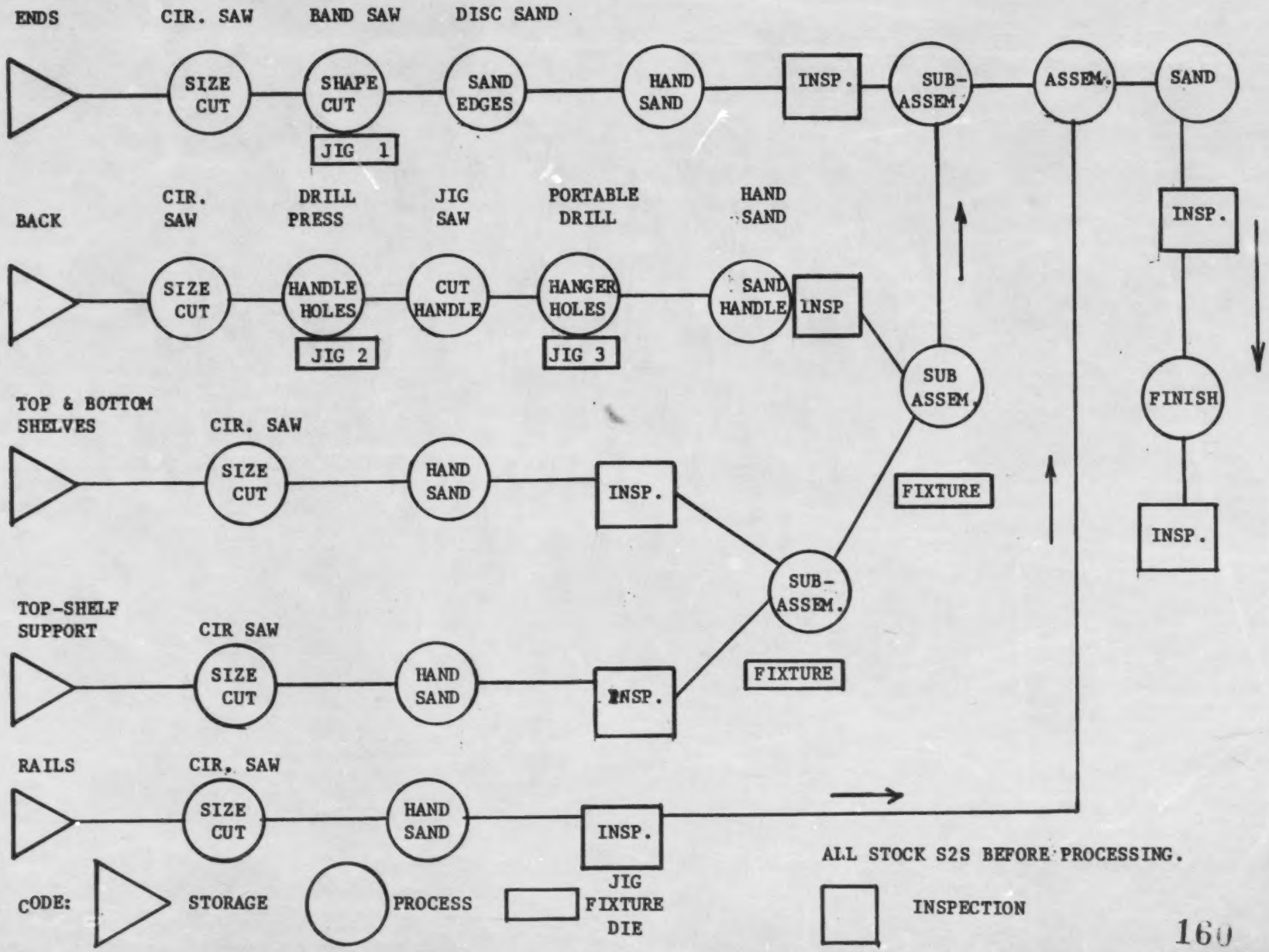
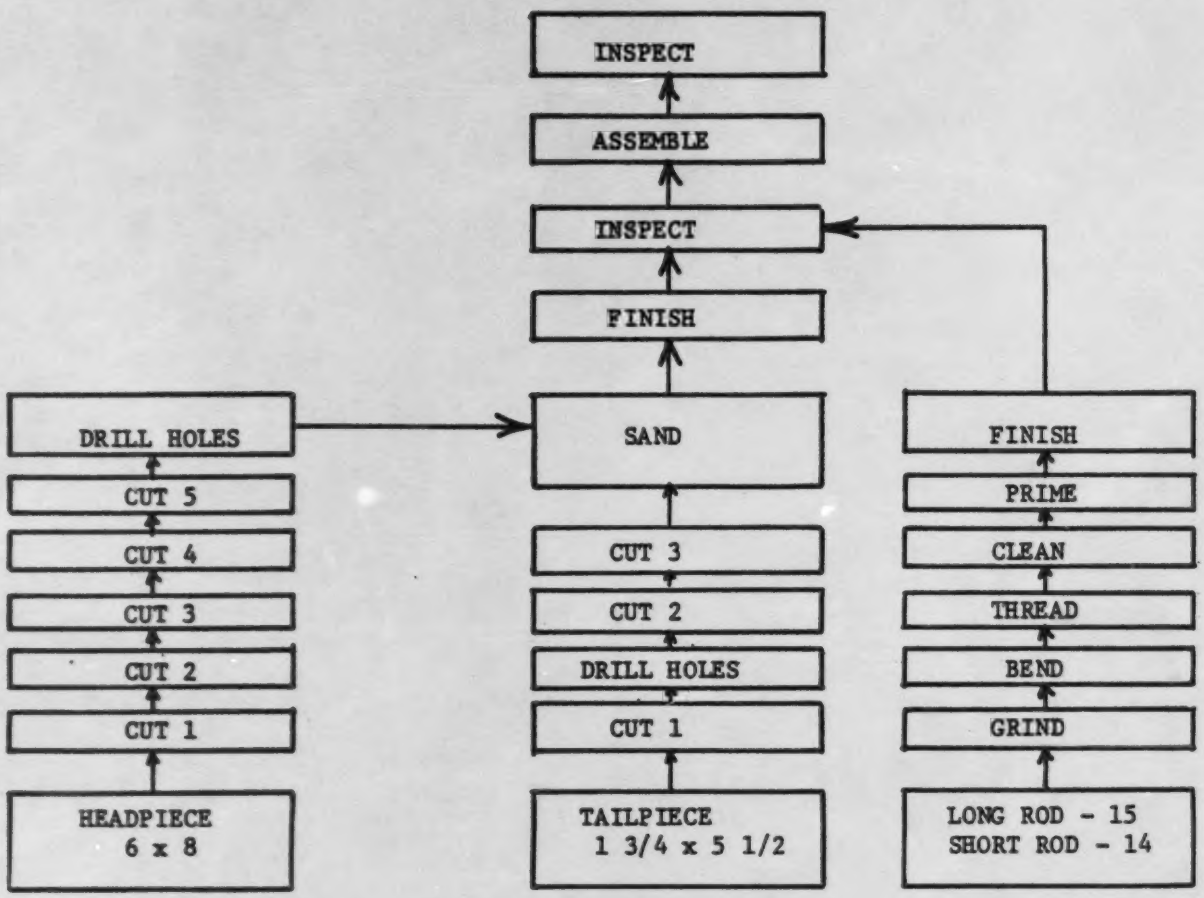
MANUFACTURING PROCESS CHART

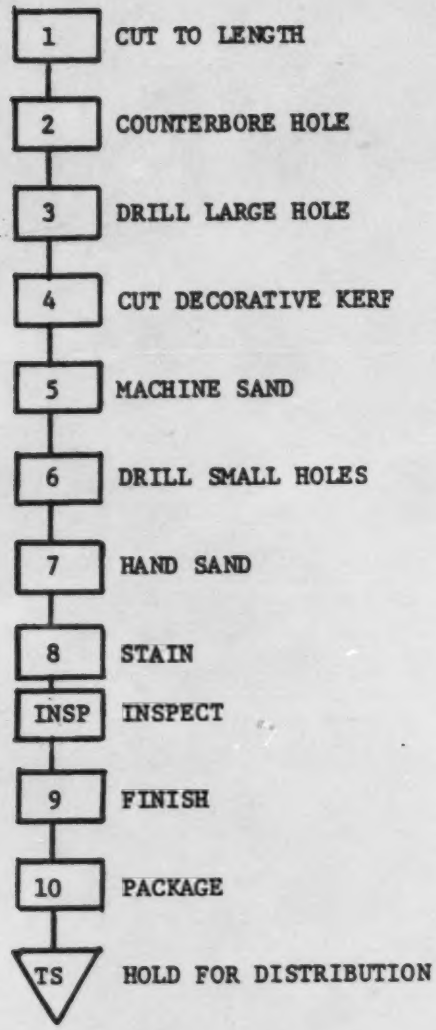


PRODUCTION CONTROL CHART



The production control chart shows the movement of materials to the machines and then to the assembly area.

PRODUCTION FLOW CHART



PROCESSING OPERATIONS

FORMING	SEPARATING	CONDITIONING	FINISHING	COMBINING
Peening	Screening	Coring	Spraying	Mixing
Rolling	Floating	Crystalizing	Brushing	Beating
Drawing	Filtering	Heat Treating	Rolling	Agitation
Pressing	Magnetizing	Melting	Dipping	Atomization
Forging	Evaporating	Freezing	Printing	Compounding
Stamping	Drying	Fermentation	Dyeing	Assembling-Fastening (joining)
Bending	Absorbing		Calendar Coating	Laminating
Extruding	Crushing		Oxide Coating	Felting
Spinning	Turning		Enameling	Welding
Molding	Shaping		Buffing	Brazing
Casting	Planning		Burnishing	Soldering
Blowing	Drilling		Flame Finishing	Pinning
Pressing	Boring		Electro Deposition	Shrinking
Vacuum Forming	Broaching			Pressing
	Sawing			Bonding
	Abrading Engraving			Mechanical Fasteners (thread and non-thread)
	Shearing Chipping			
	Etching Heat			
	Burning Light			
	Punching Milling			

OUTLINE

I. WOOD

A. GLUE
1. White
2. Powdered Resin
3. Contact Cement
4. Duco (clear, fast drying)
5. Epoxy

B. JOINTS
1. Rabbet
2. Dado
3. Dado
4. Groove
5. Mortise & Tennon
6. Dovetail

C. SCREWS
1. Flathead
2. Roundhead

D. NAILS
1. Box
2. Common
3. Finish
4. Brads
5. Ring

E. GUSSETS
1. Boat Frames
2. Rafter Construction

F. CORREGATED METAL FASTENERS

G. STAPLES

H. CLAMPS
1. Bar
2. Hand Screw
3. C Clamp
4. Miter
5. Belt

I. MODERN SOPHISTICATED METHODS

II. PLASTICS

A. LAMINATING CEMENTS

B. RESINS
1. Casting
2. Laminating
3. Coating
4. Finishing

C. WELDING
1. Pipe
2. Flat

III. GRAPHICS

A. BOOKBINDING
B. LACING
C. SCREW POST

IV. WELDING

A. ARC OR ELECTRIC
B. GAS
C. BRAZING
D. SOLDERING
E. SPOT OR RESISTANCE

V. METAL

A. RIVETS
1. Materials
a. steel
b. aluminum
c. copper
d. brass
2. Round Head
3. Countersunk Head
4. Flat Head
5. Pop Rivet

B. NUTS AND BOLTS
1. Carriage
2. Machine
3. Cap Screws

C. HARDWARE
   1. Hinges
   2. Hasps

D. SHEET METAL
   1. Seams and Hems
   2. Screws
   3. Solder

JOB SHEET

HOW TO MAKE FLANNEL BOARDS AND FLANNEL GRAPHICS

A satisfactory board for use can be designed and easily constructed from common and inexpensive materials.

Materials Required:

1. Sheet of 1/4" plywood or composition-type board about 34" x 46" or larger.
2. Sheet of flannel material 36" x 48" (must be two inches larger than board in both directions).
3. Rubber cement.
4. Stapler

The flannel material may be felt or any cotton flannel. The type of material used for quilt backing is satisfactory and is generally available.

Steps in making a flannel board:

1. Spread rubber cement over the entire surface of the plywood.
2. Place the flannel over the cemented board, smooth, and press down. Make sure that the flannel overlaps the board on all four sides.
3. Bend overlap on to the back side of the board and staple in place.

Flannel graphics can be made using show card board or any stiff cardboard. Flocked paper with adhesive backing to adhere to the cards can be purchased from school supply houses. As an alternative procedure, flocking material can be sprayed on the cards. A description of this method follows:

Materials Required:

Flannel board cards
Flocking (in tube container)
Clear enamel (in spray can)

Steps in flocking:

1. Spray enamel on back surface of card.
2. Spray flocking over enamel.
3. Spray flocking lightly with enamel to make flock stand up.

The cards may be cut to desired shapes and lettered, using magic marker or any other conventional lettering equipment.

A typical job sheet.

Operation Sheet

This type of sheet is based on a doing, or performance, element of the analysis. The title of the operation sheet should match that of the corresponding doing, or performance, element.

An operation sheet provided step-by-step instructions for performing the unit along with brief explanations as needed; it is usually provided with graphic or pictorial illustrations. As you will want to use readily available printed material and not attempt to write all of your own operation sheets, your main concern will be to identify usable materials in any form and organize them to facilitate their use. One way is to place the title of each doing, or performance, element on a card, after which the appropriate references are listed by page number. From this organization of resources, you can draw content to prepare an operation sheet, or refer a student to the performance element, or operation, that already exists in a text book or reference.

The student using an operation sheet must perform each step before going to the next. In contrast with an information sheet, operation sheets require the use of tools, equipment, and materials. Appropriate checks and standards should be included so that students know when they have performed each step, properly. Normally an operation sheet should contain the following elements:

1. Title to properly identify the procedure on which the sheet is based.
2. Introduction to describe the procedure and how it is used on the job.
3. Tools and materials a list of tools, equipment, and materials needed to perform the operation.
4. Steps of procedure a list of the steps of procedure with pictorial illustrations and very brief written explanations of how to perform each step, including notes on safety.
5. Performance checks and/or standards to let the student know how he is progressing.
6. Questions to direct the student's attention to the key points and basic concepts behind the specific steps of procedure. This has important transfer of training value.
7. References a list of sources of further information. May include other instruction sheets as well as textbook material.

Assignment Sheet

This type of instruction sheet, as the name suggests, gives specific directions as an assignment to the student. It generally refers the learner to

a resource and assigns certain pages to be read and problems to work or questions to answer. Assignment sheets are used in application steps of lessons in science subjects, mathematics, and drawing, and for related reading assignment sheets to distinguish them from the modified job sheet, or job assignment sheet. An assignment sheet should contain these elements:

1. Title a short statement of what the assignment includes, the amount of time it should take, the value of the assignment to the student and a sentence of two to stimulate interest.

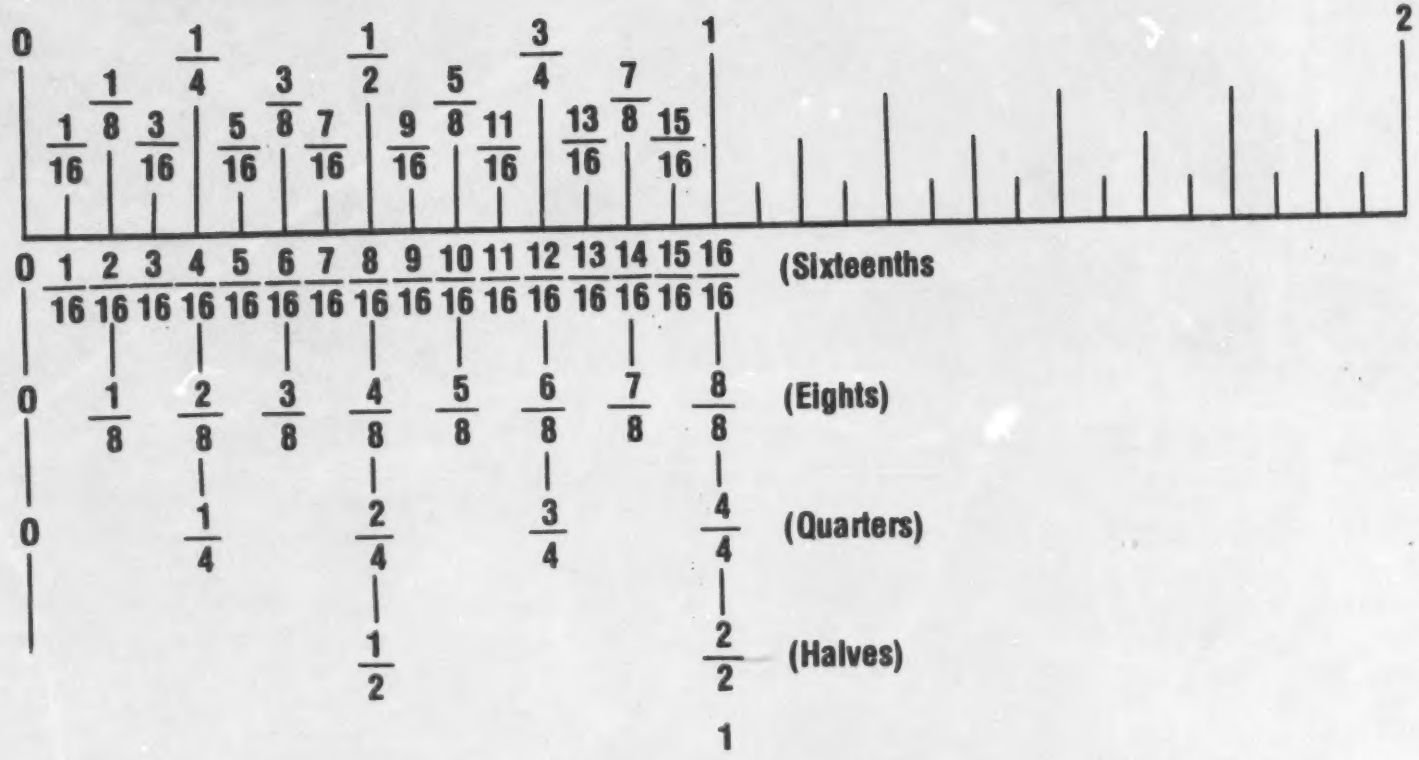
2. Directions a statement which makes the specific assignment and tells the student exactly what to do.

3. References others as needed.

Habits of accuracy and neatness are also stressed. The assignment takes about 30 minutes. The results are easy to check by observation or transparent overlay.

In addition to providing for application and practice, assignment sheets may be used to develop problem solving and creative abilities.

READING A RULE



UNDERSTANDING FRACTIONS

1. PARTS OF A FRACTION ARE: $\frac{3}{4}$ [Numerator] / [Denominator] [Divisor Line] (N÷D)

2. ALWAYS REDUCE TO LOWEST TERMS: $\frac{8}{16}=\frac{1}{2}$

(CALCULATING FRACTIONS)

A. ADDING: (1) $\frac{1}{4}+\frac{1}{4}=\frac{2}{4}=\frac{1}{2}$ (2) $\frac{1}{2}+\frac{3}{8}=\frac{4}{8}+\frac{3}{8}=\frac{7}{8}$

(3) $\frac{3}{4}+\frac{7}{8}=\frac{6}{8}+\frac{7}{8}=\frac{13}{8}$ $(13\div 8)=1\frac{5}{8}$

B. SUBTRACTING: (1) $\frac{3}{4}-\frac{1}{8}=\frac{6}{8}-\frac{1}{8}=\frac{5}{8}$ (2) $\frac{3}{16}-\frac{1}{16}=\frac{2}{16}=\frac{1}{8}$

(2) $3\frac{3}{8}-1\frac{3}{4}=3\frac{3}{8}-1\frac{6}{8}$ ($\frac{6}{8}$ can't be subt. from $\frac{3}{8}$)

$3\frac{3}{8}\left[2+\frac{8}{8}+\frac{3}{8}\right]=2\frac{11}{8}-1\frac{6}{8}=1\frac{5}{8}$

C. DIVIDING: (1) $\frac{3}{4}\div 2=\frac{3}{4}\times\frac{1}{2}=\frac{3}{8}$ (2) $\frac{7}{8}\div 2=\frac{7}{8}\times\frac{1}{2}=\frac{7}{16}$

D. MULTIPLYING: (1) $\frac{3}{4}\times 2=\frac{3}{4}\times\frac{2}{1}=\frac{3}{2}=1\frac{1}{2}$ (2) $\frac{1}{4}\times\frac{1}{8}=\frac{1}{32}$

STUDENT'S PLAN SHEET

Student's Name_____ Class_____

Name of Project_____ Date Started_____ Date Completed_____

Estimated Time_____ Actual time_____

Personal efficiency: actual time ÷ estimated time = _____%

Source of drawing _____

MATERIALS REQUIRED

No. of pieces	Description and size of piece	Kind of materials	Unit Cost	Extended Cost

Tools:

1.	5.	9.
2.	6.	10.
3.	7.	11.
4.	8.	12.

Order of Procedure:

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.

Approved_____

Working sketch or drawing required with this form.

PROJECT PLANNING

Name(s) _____ Class/Period _____

Project Name _____

Type of Project: Individual _____ Group _____ Mass Production _____

Date Begun _____ Estimated Completion Date _____

PLAN OF PROCEDURE

OPERATIONS	TOOLS REQUIRED PER OPERATION
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Instructors's Approval: _____

Comments: _____

_____

_____

Date Completed _____ Total hours spent on project _____

Working Drawing Grade _____ Final Project Grade _____

Comments: _____

_____

_____

PROJECT BILL OF MATERIALS

PART A: Finished dimensions of assembled parts. *Parts layout sheet (graph paper etc.) recommended.

Part #	No. of Pcs.	*Finished Size and Tolerance Thk.	X	W	X	L	Type of Material

PART B: Stock Materials/Supplies

Part #	No. of Pcs.	Stock Sizes Thk. X W X L	Material/Supplies	Unit Quality	Cost Per Unit	Total

Total Value _____

Less No Charges _____

TOTAL DUE _____

PROJECT PLANNING AND EVALUATION
(place complete working drawing on reverse side)

Grade_____

Your name _____ Learner level _____

Project _____ Source of Idea _____

Date Begun_____ Date Finished_____ Cost_____

Total Time_____

Instructor's Approval_____ Comments _____

PLANNING

MAIN OPERATIONS

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____

TOOLS NEEDED

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____

(continue on separate piece of paper if more room is needed)

Part#	No. of Pieces	Size W	Size T	Size L	MATERIAL NEEDED Material	Unit Cost	Total Cost

TOTAL_____

PROJECT SELF-EVALUATION FORM

NAME _____ COMPLETION TIME _____

PROJECT _____ SCORE _____ GRADE _____

CODE 4-Excellent
3-Above average
2-Average
1-Below average

I. DESIGN

A. Functional Requirements.
1. Does project serve its intended purpose? 1 2 3 4
2. Does project perform efficiently? 1 2 3 4

B. Material Requirement.
1. Does project reflect simple, direct, and practical uses of materials? 1 2 3 4
2. Were materials used to their best? 1 2 3 4
3. Was maximum use received from minimum materials? 1 2 3 4
4. Were characteristics of materials observed? 1 2 3 4

C. Visual Requirements.
1. Does it look right; is it interesting? 1 2 3 4
2. Does it exhibit good proportion and balance? 1 2 3 4

II. PLANNING

A. Is working sketch complete and orderly? 1 2 3 4
B. Does plan of procedure follow a logical order? 1 2 3 4
C. Is bill of materials complete? 1 2 3 4

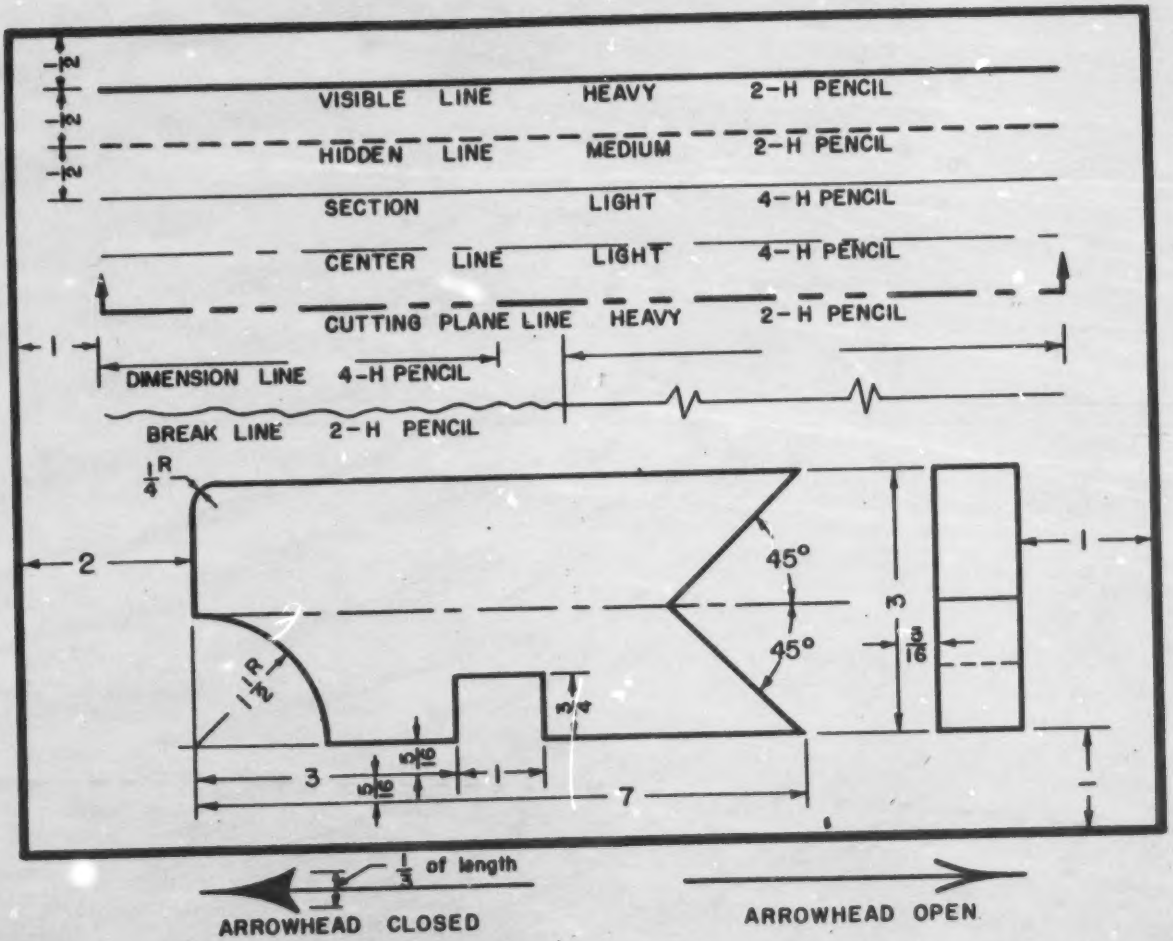
III. CONSTRUCTION

A. Were safety precautions observed? 1 2 3 4
B. Were machines properly used? 1 2 3 4
C. How well were mistakes corrected? 1 2 3 4
D. Did I work accurately and carefully? 1 2 3 4
E. Was skill exhibited in the use of:
1. Layout and measuring? 1 2 3 4
2. Cutting tools? 1 2 3 4
3. Machining? 1 2 3 4
F. To what extent did I keep profitably busy? 1 2 3 4
G. Did I show initative and resourcefulness? 1 2 3 4

IV. COMPLETION

A. Is project's general appearance neat and orderly? 1 2 3 4
B. Do joints properly fit?
C. Do dimensions of project correspond with drawing? 1 2 3 4
D. Were materials used to best advantage? (grain matched, best faces exposed, etc.) 1 2 3 4
E. What quality is the finish? 1 2 3 4

ALPHABET OF LINES



ABRASIVE GRADING CHART (Comparison of mesh and grit numbers)

Classification and Use	Artificial	Natural		
	Silicon carbide, aluminum oxide	Garnet	Flint (quartz)	Emery
Extra coarse	12			
(sanding coarse wood texture)	16	16(4)		
	20	20(3½)		
Very coarse	24	24(3)		
(second stage in sanding wood texture)	30	30(2½)	Extra Coarse	Very Coarse
	36	36(2)		
Coarse	40	40(1½)		
(third stage in sanding wood texture)	50	50(1)	Coarse	
Medium	60	60(½)		Coarse
(removing rough sanding texture)	80	80(0)	Medium	
	100	100(2/0)		Medium
Fine	120	120(3/0)		
(first stage in sanding before applying finish)	150	150(4/0)	Fine	Fine
	180	180(5/0)		
Very fine	220	220(6/0)	Extra Fine	
(second stage in sanding before applying finish)	240	240(7/0)		
	280	280(8/0)		
Extra fine	320	320(9/0)		
(rubbing between finish coats)	360			
	400	400(10/0)		
	500			
	600			

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SELECT THE FINISH THAT BEST SUITS YOUR NEEDS

COMMON FINISHES	MATERIALS USED ON	SOLVENT*	DRYING TIME BETWEEN COATS	CHARACTERISTICS GOOD	CHARACTERISTICS POOR
STAIN					
Water	Wood	Water	8 hrs.	Easy to use Good penetration Inexpensive	Raises the wood grain **
Vinyl	Wood	Water	1 hr.	Water cleanup Choice of colors Brush or Wipe on	
Oil	Wood	Mineral Spirits	8 hrs.	Easy to use Rich color Brush on and wipe off when desired shade is reached	
CLEAR WOOD FINISHES					
Clear Wood Finish (Daft)	Wood	Lacquer Thinner	20 min.	Can be brushed or sprayed Shows no brush marks Easy to apply Doesn't darken with age Easy touch-up Resists water, heat, and alcohol	
Acrylic (Wood Armor)	Wood	Water	1 hr.	Easy to use Water cleanup Dries clear	Two or more coats should be applied
Lacquer	Wood	Lacquer Thinner	15 min.	Usually sprayed, but can be brushed on or applied by dipping	Requires two or more coats Toxic (poisonous) fumes
Varnish, Polyurethane	Wood Metal	Mineral Spirits	24 hrs.	Clear, tough, hard Resists oil, water, and alcohol	Hard to touch-up
Shellac	Wood	Alcohol	2 hrs.	Easy to apply Good penetration Good Sealer	Poor resistance to heat Not waterproof
PENETRATING OILS					
Mineral Oil	Wood	Mineral Spirits	4 hrs.	Easy to apply Non-Toxic Good to use on cutting boards	Not permanent
Danish Oil (Watco)	Wood	Mineral Spirits	4 hrs.	Easy to apply Toughens wood surface	May discolor finish coat if not sealed
PAINT					
Enamel	Wood Metal	Mineral Spirits	12 hrs.	Waterproof Can be brushed or sprayed Tough, hard	
Latex	Wood	Water	4 hrs.	Odorless Water cleanup	
Lacquer	Metal	Lacquer	15 min.	Usually sprayed, but can be brushed on or applied by dipping Resists water, heat, and alcohol	Required two or more coats Toxic fumes
WAX	Wood Metal Plastic	-	10 min.	Portects surface Makes the surface shine Can be used alone or applied over other finishes	

* Material used to thin the finish and for cleanup.
**Causes the wood fibers to rise up. This makes the surface rough.

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WOOD FINISHING CHART

Step #	Operation
1.	Raise the grain with water. Sand when dry.
2.	Water stain; any color.
3.	Oil stain; any color.
4.	Ivory oil stain.
5.	Bichromate of potassium.
6.	Paster paint; any color.
7.	White shellac; one thin coat.
8.	Paste wood filler; Walnut.
9.	Paste wood filler; Natural.
10.	White shellac; 4 coats.
11.	Varnish; 4 coats.
12.	Enamel; 4 coats.
13.	Sanding sealer; 3 coats.
14.	Brushing lacquer; 2 coats.
15.	Spraying lacquer. 2 coats.
16.	Linseed oil to bring out grain.
17.	Oil stain; Brown.
18.	Linseed oil; Rubbed many coats.
19.	Wood filler; Silver, Gray.
20.	Sand between coats; No. 3/0 sandpaper.
21.	Sand last coat; No. 4/0 and 3F pumice, wet in oil (Rubbing Oil)
22.	Paste wood filler; White.
23.	Maple oil stain.
24.	Steel wool; No. 2/0.
25.	Wire brush.
26.	Rottenstone and oil, with felt pad. (Rubbing Oil)
27.	Paste floor wax.
28.	Picture transfer.
29.	Shellac, rubbed; many coats.
30.	Shellac; 1 coat to hold pitch.
31.	Dextrine glue.
32.	Chlorox, or other bleaches. (Poison)
33.	Water stain; Brown.
34.	Borax solution; (Neutralizer)
35.	Flat varnish, 2 or 3 coats.
36.	Sand after second coat; No. 3/0 sandpaper.
37.	Silver grey, oil stain.
38	Wood filler; colored to match stain.

NOTE: Rubbing oil made of 1/2 kerosene and 1/2 machine oil.

Wood		Remarks	Operation Number
Black Walnut	1	Light rubbed varnish finish	7 8 11 20 21 26 27
Black Walnut	2	Dark rubbed varnish finish	8 11 20 21 26 27
Black Walnut	3	Rubbed oil finish	8 18
Red Cedar	1	Light rubbed shellac finish	10 20 21 26 27
Red Cedar	2	Dark rubbed varnish finish	16 11 20 21 26 27
Red Cedar	3	Light clear lacquer finish	13 20 15 21 26 27
Gum Wood	1	Rubbed shellac on figured gum	16 10 20 21 26 27
Gum Wood	2	Walnut imitation on plain gum	1 33 24 11 20 21 26 27
Birch	1	Natural clear lacquer finish	13 14 20 21 26 27
Birch	2	Water stained rubbed varnish	1 2 24 11 20 21 26 27
Maple	1	Oil stained rubbed varnish	23 11 20 21 26 27
Maple	2	Natural rubbed shellac finish	10 20 21 26 27
Maple	3	Old English finish	1 5 24 11 20 21 26 27
Maple	4	Bleached	32 34 13 20 14 21 26 27
Mahogany	1	Water Stained rubbed varnish	1 2 24 38 11 20 21 26 27
Mahogany	2	Oil stain rubbed varnish	3 7 38 11 20 21 26 27
Mahogany	3	Spanish finish	1 33 24 22 7 27
Mahogany	4	Silver grey rubbed shellac	37 19 10 20 21 26 27
Mahogany	5	Bleached lacquer finish	32 34 22 13 20 14 21 26 27
Mahogany	6	Natural rubbed varnish finish	9 11 20 21 26 27
Quartered Oak	1	Natural rubbed varnish finish	9 11 20 21 26 27
Quartered Oak	2	Stained rubbed varnish finish	17 7 8 11 20 21 26 27
Plain Oak	3	Stained rubbed varnish finish	3 7 38 11 20 21 26 27
Red Wood	1	Natural varnish finish	11 20 21 26 27
Red Wood	2	Weathered flat varnish finish	1 5 35
Oregon Pine Or	1	Vertical grain rubbed shellac	10 20 21 26 27
Douglas Fir	2	Pickle finish flat varnish	4 35 35 20
Douglas Fir	3	Slash grain; rubbed varnish	3 30 11 20 21 26 27
Douglas Fir	4	Slash grain wire brushed	25 4 21 24 27
Sugar Pine Or	1	Natural white shellac finish	10 20 21 26 27
White Pine	2	Paster paint shellac finish	1 6 10 36 21 26 27
White Pine	3	Enamel and transfer	30 12 20 21 26 28 27
White Pine	4	Crackle finish	31 6 10

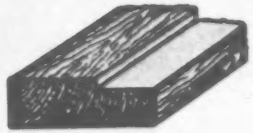
The following four charts have been provided by Stanley Tools, Division of Education Sales, New Britain, Connecticut, 06050. Used with permission of Stanley Tools.

STANLEY

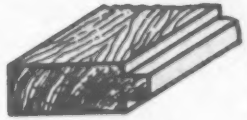
STANLEY

PLOW

DADO



RABBET



TONGUE

GROOVE

BEVEL

CHAMFER

STOP CHAMFER

NOSING

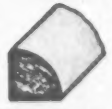
CENTER BEAD

EDGE BEAD

ROUND

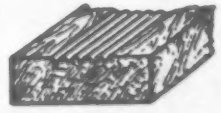
FLUTE

HOLLOW



1/4 ROUND

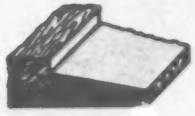
COVE OR 1/4 HOLLOW



REED

REVERSE OGEE

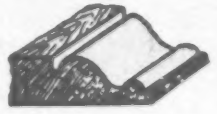
ROMAN OGEE



SHIP LAP

COMMON OGEE

ASTRAGAL



GRECIAN OGEE WITH BEAD

BEVEL SASH

OGEE SASH

OVALO SASH

STANLEY TOOLS
NEW BRITAIN, CONN. U.S.A.

EDUCATIONAL DEPARTMENT
CHART NO. 4

112

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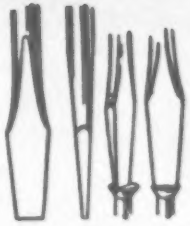
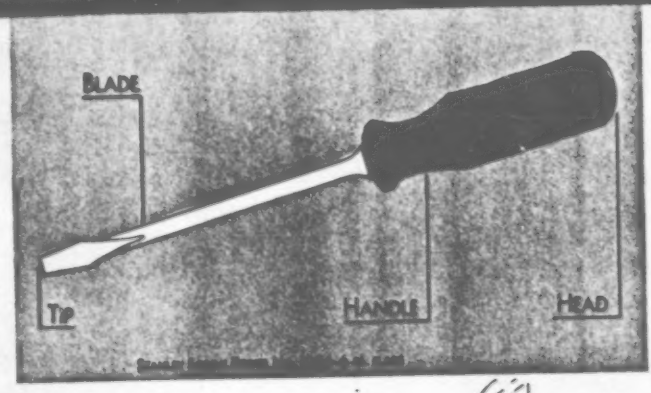
STANLEY



SELECT A SCREW DRIVER OF LENGTH AND TIP FITTED TO THE WORK.
SCREW DRIVERS ARE SPECIFIED BY THE LENGTH OF THE BLADE.
THE TIP SHOULD BE STRAIGHT AND NEARLY PARALLEL SIDED. IT SHOULD ALSO FIT THE SCREW SLOT AND BE NOT WIDER THAN THE SCREW HEAD.

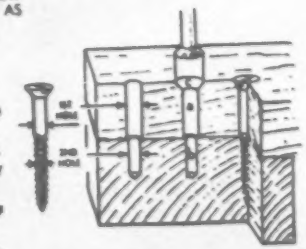
IF THE TIP IS TOO WIDE IT WILL SCAR THE WOOD AROUND THE SCREW HEAD.
IF THE SCREW DRIVER IS NOT HELD IN LINE WITH THE SCREW IT WILL SLIP OUT OF THE SLOT AND MAR BOTH THE SCREW AND THE WORK.

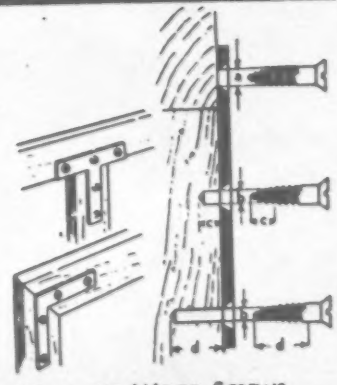
IF THE TIP IS ROUNDED OR BEVELED IT WILL RAISE OUT OF THE SLOT SPOILING THE SCREW HEAD. REGRIND OR FILE THE TIP TO MAKE IT AS SHOWN ABOVE.



USE THE LONGEST SCREW DRIVER CONVENIENT FOR THE WORK. MORE POWER CAN BE APPLIED TO A LONG SCREW DRIVER THAN A SHORT ONE, WITH LESS DANGER OF ITS SLIPPING OUT OF THE SLOT.
HOLD THE HANDLE FIRMLY IN THE PALM OF THE RIGHT HAND WITH THE THUMB AND FOREFINGER GRASPING THE HANDLE NEAR THE FERRULE. WITH THE LEFT HAND STEADY THE TIP AND KEEP IT PRESSED INTO THE SLOT WHILE RENEWING THE GRIP ON THE HANDLE FOR A NEW TURN.

IF NO HOLE IS BORED FOR THE THREADED PART OF THE SCREW THE WOOD IS OFTEN SPLIT OR THE SCREW IS TWISTED OFF.
IF A SCREW TURNS TOO HARD, BACK IT OUT AND ENLARGE THE HOLE.
A LITTLE SOAP ON THE THREADS OF THE SCREW MAKES IT EASIER TO DRIVE.





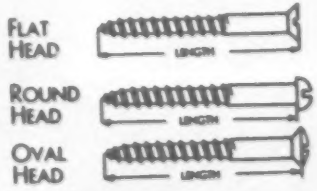
TO FASTEN TWO PIECES OF WOOD TOGETHER WITH SCREWS:

1. LOCATE THE POSITIONS OF THE SCREW HOLES.
2. BORE THE FIRST HOLE SLIGHTLY SMALLER THAN THE THREADED PART OF THE SCREW THROUGH BOTH PIECES OF WOOD AS AT b. BORE ONLY AS DEEP AS THREE QUARTERS THE LENGTH OF THE SCREW.
3. BORE THE SECOND HOLE IN THE FIRST PIECE OF WOOD SLIGHTLY LARGER THAN THE DIAMETER OF THE SCREW SHANK, AS AT a.
4. COUNTERSINK THE FIRST HOLES TO MATCH THE DIAMETER OF THE HEADS OF THE SCREWS, AS AT c.
5. DRIVE THE SCREWS TIGHTLY IN PLACE WITH THE SCREW DRIVERS.

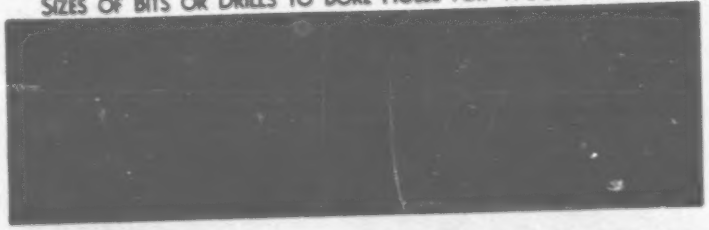
TO FASTEN HINGES OR OTHER HARDWARE IN PLACE WITH SCREWS:

1. LOCATE THE POSITION OF THE PIECE OF HARDWARE ON THE WORK.
2. RECESS THE WORK TO RECEIVE THE HARDWARE, IF IT IS NECESSARY.
3. LOCATE THE POSITIONS OF THE SCREWS.
4. SELECT SCREWS THAT WILL EASILY PASS THRU THE HOLES IN THE HARDWARE, AS AT a.
5. BORE THE PILOT HOLES (SECOND HOLE) SLIGHTLY SMALLER THAN THE DIAMETER OF THE THREADED PART OF THE SCREWS, AS AT b.
6. DRIVE THE SCREWS TIGHTLY IN PLACE.

IF THE WOOD IS SOFT, BORE AS DEEP AS HALF THE LENGTH OF THE THREADED PART OF THE SCREW, AS AT c. IF THE WOOD IS HARD, (OAK), THE SCREW SOFT (BRASS), OR IF THE SCREW IS LARGE, THE HOLE MUST BE NEARLY AS DEEP AS THE SCREW, AS AT d. HOLES FOR SMALL SCREWS ARE USUALLY MADE WITH BRAD AWLS.



SIZES OF BITS OR DRILLS TO BORE HOLES FOR WOOD SCREWS



DETERMINE SCREW SHANK SIZES BY COMPARISON BELOW

EXACT SIZES CANNOT BE GIVEN FOR THE HOLES FOR WOOD SCREWS. THE ABOVE ARE APPROXIMATELY RIGHT FOR AVERAGE NEEDS. VARIATIONS IN HARD AND SOFT WOOD, MOISTURE CONTENT AND SNUG OR LOOSE FITS, IF DESIRED, SHOULD BE CONSIDERED. NUMBER AND LETTER SIZES OF DRILLS ARE AVAILABLE, IF MORE EXACT SIZES ARE WANTED. A TRIAL FIT IN SCRAP WOOD IS PRACTICAL.

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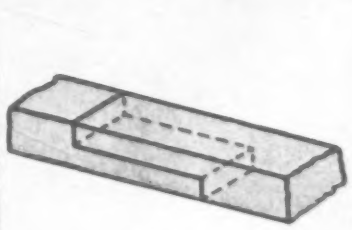
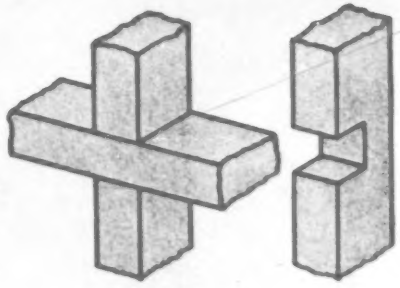
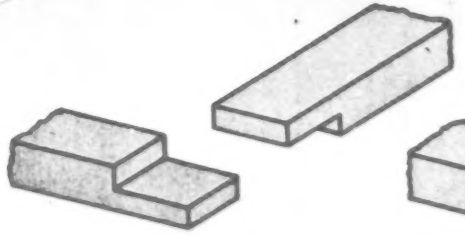


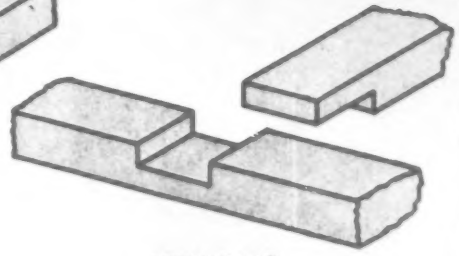
HALF LAP



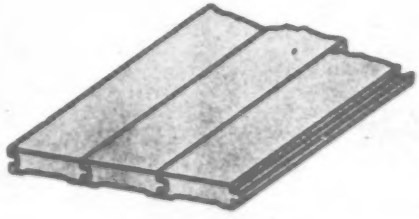
CROSS LAP



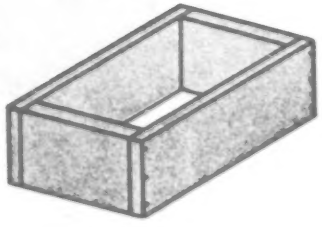
END LAP



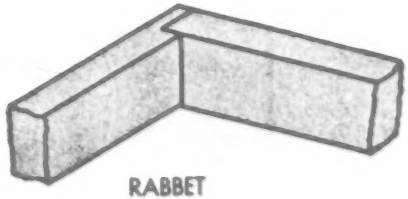
MIDDLE LAP



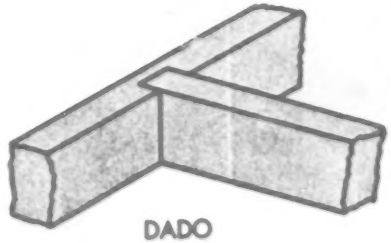
TONGUE & GROOVE



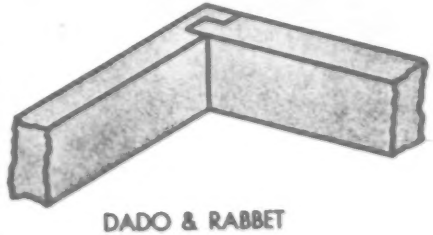
BUTT



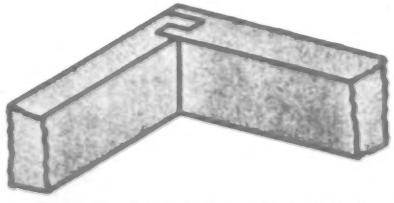
RABBET



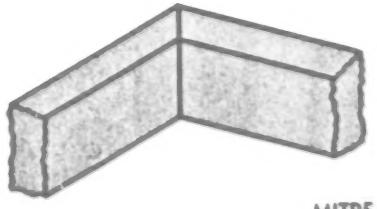
DADO



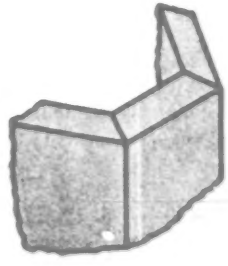
DADO & RABBET



DADO TONGUE AND RABBET



MITRE



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114

APPENDIX B

Most of the diagrams, sample tests, guides and forms in this section were adopted from the "Safety Guide...Administrator and Instructor Section " published by the Industrial Arts section of the Washington State Department of Education and the "Safety Guide" Second Edition published by the Industrial Arts section of the Pennsylvania Department of Education.

Both of these publications are excellent sources of information and sincere thanks are extended to these two agencies for their permission to reproduce these materials.

What have you got to lose?

Your eyes

Watching television
A sunset
A good book
A friend's smile
An attractive person

Your hearing

Laughter of a friend
A bird at your window
A rock concert
The call of your name

Your hands

A game of softball
Buttoning your shirt
Driving a motorcycle
Holding hands with a special person

Your back

Playing on the beach
Getting into your car
A day skiing
Dancing
A comfortable night's sleep

Your legs

A walk on the beach
A game of tennis
Running and hiking
A bicycle ride

Your life

The remainder of today, every tomorrow. The entire rest of your life.

That's what you've got to lose!

RESPONSIBILITY

The school board, the administration, and the instructor have the legal responsibility to provide a safe place for students to work while they are participating in Industrial Arts activities.

To protect yourself and your parish from liability you should be familiar with and follow the codes and regulations applicable to your program.

To protect yourself against financial loss, liberal liability insurance limits should be carried, either through the parish policy or as an individual.

Liability insurance can vary substantially among parishes. You should be aware of the limitations of your parish liability policy.

Individual coverage may be expanded through the Louisiana Association of Educators, other educational associations, or through your personal insurance agent or broker.

Safety is not a "one man show." The school board and superintendent, the parish safety coordinator, the administrator (principal or department head), and the teacher all need to do their part.

School board and Superintendent. 119

Parish Safety Coordinator (Vocational Supervisor). 120

The Administrator
Principal or Department. 121

The Teacher. 123

School Board and Superintendent

The parishes control budget, curriculum and personnel policy to a major degree. Without parish-level support, safety program effectiveness will be at best spotty, carried out by dedicated personnel and ignored by others.

The following functions are considered the responsibility of the school board and the superintendent in a comprehensive Industrial Arts Safety Education Program:

1. Fund necessary improvements and maintenance to facilities, as well as safety supplies and equipment to produce a safe instructional environment.

2. Support instructional control measures to promote safety within the Industrial Arts program.

3. See that Industrial Arts curriculum devotes sufficient time for safety instruction.

4. Review and maintain adequate liability insurance coverage to protect the parish administrators and the instructor from liability claims.

5. Evaluate performance of the school administration and teachers regarding safety procedures, equipment and instruction quality.

6. Provide for the safety of the students when innovations involving curriculum changes are made.

7. Include a safety review as an integral part of the design for new or remodeled facilities.

8. Appoint a safety coordinator for the parish who is self-motivated as well as having a zeal to help others in their accident prevention programs.

9. Make insurance available so that the student may purchase it at a reasonable cost.

Parish Safety Coordinator (Vocational Supervisor)

Each parish should have a safety coordinator. Teachers and the site administrator should look to the parish safety coordinator for assistance and consultation in their accident prevention endeavors.

The following functions are considered the responsibility of the parish safety coordinator:

1. Coordinating school safety functions.
2. Setting up school safety committees.
3. Providing for and participating in school safety inspections.
4. Obtaining and disseminating regulatory material (policies, guidelines, inspection checklist, posters, etc.).
5. Assisting in establishing in-service training programs.
6. Establishing a communication system to keep teachers and administrators abreast of new standards and procedures.
7. Assisting in investigating and recording accidents and injuries.
8. Researching special safety problems and analyzing all accidents.
9. Assisting in the implementation of safety instruction program for students.
10. Maintaining a liaison with the Division of Industrial Safety and Health (D.I.S.H.), Department of Labor and Industries.

The Administrator (Principal or Department Head)

The individual school is the central unit of an educational enterprise. Therefore, the building principal is likely to be the administrator who is most directly concerned with the school laboratory safety program. If a specialized supervisor or department head functions under the principal and works directly with the teachers, some of the responsibilities for the safety program may be delegated.

The following functions are generally considered the responsibility of the school administrator in a comprehensive Industrial Arts Safety Education Program:

1. Secure support from and maintain liaison with top school system administration.

   a. Secure approval for the safety education program.

   b. Secure adequate budgetary support.

   c. Expedite building changes necessary for safe operation.

   d. Arrange for procurement of safety equipment.

   e. See that appropriate staff members are kept informed of the specific maintenance requirements for safe operation of Industrial Arts facilities.

2. Provide leadership in planning the program.

   a. Initiate a specific program of safety education.

   b. Carefully select Industrial Arts instructors and substitutes for temperament, specific Industrial Arts education, knowledge and skill so that safe work, equipment operation and personal protective measures will be taught and followed.

   c. Set up in-service training in accident prevention for teachers.

   d. Maintain contact with parents to aid safety program and to take administrative measures to reduce liability exposures.

3. Secure action on a program of safety education that will involve not only the Industrial Arts student but also the entire student body.

   a. Check periodically to make sure an adopted safety education program is in effect.

The Administrator (Principal or Department Head) - Continued

b. Observe teachers for assurance that safety instruction is a functioning part of the course of study.

c. Stimulate the discovery, analysis and prompt correction of unsafe conditions or practices.

d. Support teachers in erforcing safety regulations.

e. Receive and review accident reports.

f. Utilize parish procedures for investigating and analyzing accidents.

g. See that instructional staff maintains first aid proficiency and that supplies and emergency handling procedures are current and properly maintained.

4. Provide safe facilities and services.

a. Report unsafe conditions which cannot be corrected at school level to higher authority.

b. Plan with teachers for the removal of unsafe conditions and other hazards, and the installation of safety devices.

c. See that Industrial Arts facilities are regularly inspected for condition of equipment and safety devices, proper housekeeping, adequacy of exits, ventilation and refuse handling systems, and make the necessary changes as needed.

d. See that safety and applicable safety regulations are specifically reviewed in the planning of new or remodeled facilities.

e. Provide classloads that are in keeping with the capacity, square footage, and number of work stations available in each facility.

5. Secure cooperation of outside personnel and agencies.

a. Assist the teachers in locating qualified community personnel and services which will be helpful in the safety program.

b. Encourage qualified outside individuals to assist in the school shop safety program.

The Administrator (Principal or Department Head) - Continued

c. Establish communication with parents and members of the community for developing a positive attitude toward safety and the Industrial Arts safety program.

The Teacher

The major responsibility for laboratory safety instruction in accident prevention falls on the teacher. The following are generally considered the responsibilities of the teacher in a comprehensive accident prevention program in school laboratories.

1. Incorporate safety instruction in the course of study and maintain documentation as to who received instruction and when instruction was given.

2. Give instruction on potential hazards and accident prevention specific to the particular school laboratory.

3. Instigate a comprehensive safety program and enforce all rules and regulations.

4. Have set, pre-planned procedures in case of an emergency.

5. Set proper safety examples for students to follow.

6. Keep informed about modern and accepted safe practices in the field of accident prevention.

7. Regularly review laboratory facilities to provide for optimum safety conditions. Give special attention to:

   a. Layout.

   b. Utilities and building services.

   c. Equipment guarding.

   d. Storage and condition of tools, and

   e. Storage, labeling and handling of materials.

8. Carry out recommendations of the administrator for improving safety instruction.

9. Devise and enforce safe housekeeping procedures.

The Teacher - Continued

10. Insist on proper protective equipment in all shop areas and require students to wear proper clothing and adequate hair guards while working in the laboratory.

11. Develop specific safe practices and regulations relating to your facilities.

12. Make recommendations to administrators for improving environmnetal safety conditions.

13. Produce prompt and thorough reports of accidents.

14. Be aware of the emotionally disturbed and accident prone student.

15. Always provide for the supervision of students in the classroom or laboratory in accordance with legal requirements. NOTE: DO NOT LEAVE THE CLASSROOM UNSUPERVISED AT ANY TIME WHEN STUDENTS ARE PRESENT.

16. Insist that adequate eye protection be worn in all potentially hazardous areas.

17. Provide proper instruction in the use of all tools, machines and equipment. Keep a record of each student's safety training.

18. Insist that guards meeting accepted standards be provided and used whenever a machine is operated.

GENERAL SAFETY INSTRUCTIONS FOR ALL AREAS OF INDUSTRIAL ARTS

1. Approval of instructor must be obtained for work on all machines or in potentially hazardous areas.
2. Report all injuries, however slight, to your instructor immediately.
3. Wear eye protection as required by law.
4. If your hairstyle presents a potential hazard, you must fasten it securely or wear a protective hair cover.
5. Suitable clothing must be worn for all laboratory activities. Remove or fasten any loose clothing, neckties or jewelry. Roll loose sleeve to elbows.
6. Obey rules concerning operators' safety zones.
7. Cooperate with your classmates in the management of your Industrial Arts safety program.
8. Caution any student committing an unsafe act.
9. Report to instructor any equipment that does not <u>seem</u> to work properly.
10. Keep tools and materials from projecting over the edge of benches.
11. Use a brush to clear away dry chips. Use a rag to clean oily areas.
12. Keep floor and work surfaces clear of scraps and litter.
13. Wipe up immediately any liquids spilled on the floor.
14. Be sure projecting drawers and doors are kept closed.
15. Place oily rags and other combustible materials in approved metal containers.
16. Use care in handling and storing large, heavy or long pieces of material.

GENERAL SAFETY RULES FOR POWER TOOLS

1. Do not operate any machine until you have received proper instruction, fully understand how to operate it, and have received the instructor's permission to use it.

2. Wear proper eye protection devices when in potential eye hazard areas.

3. Have your instructor check your work setup.

4. Check and make all adjustments before applying power.

5. Make sure other persons are clear before turning on the power.

6. Guards must be in place and function properly.

7. Start and stop your own machine and remain with it until it has come to a complete stop.

8. Only one person should operate a machine unless the operation requires a helper.

9. Do not leave a running machine unattended.

10. Disconnect electrical power before oiling and cleaning.

11. Allow a safe distance between your hands and blades, cutters or moving parts. Keep fingers in such a position that there is no danger of their slipping into the cutter or moving parts.

12. Keep machines clear of tools, stock, and other items.

13. Keep the floor around machines clear of liquids, scraps, tools, and material.

14. Give the machine your undivided attention while you are using it. Do not look away to talk to others.

15. Never lean or lounge on any machine.

16. Do not use extension cords for permanent connections.

17. Notify your instructor of any breakage or malfunction.

18. Allow all machines to come to a complete stop before removing work or making a new setup.

GENERAL SAFETY RULES FOR HAND TOOLS

1. Wear adequate eye protection devices when in potential eye hazard areas.
2. Select the proper size and type of tool for the job. Learn and follow the correct procedure for using each tool.
3. Cutting tools must be properly sharpened and in good condition.
4. Keep your hands free of oil and grease.
5. Handle sharp-edged and pointed tools with care; carry in such a way as to protect yourself and others.
6. Secure small or short work with a vise or clamp.
7. Never carry tools in your pockets.
8. Use tools only for the purpose for which they were intended.
9. Do not use tools with loose or cracked handles.
10. Keep punches and chisels in good condition. Mushroomed heads may chip and cause injuries.
11. Use a file only when it is equipped with a handle.
12. Never pry, hammer on, or hammer with a file; it may shatter.
13. Do not use screw drivers as chisels or pry bars.
14. The use of a "cheater" or any other means for increased leverage is hazardous. All wrenches are designed to a specific size-length-strength ratio.
15. Do not use a hard hammer on another hardened surface.
16. When finished with a tool, clean it and return it to the proper storage place.
17. Report any breakage or malfunctions to your instructor.

GENERAL SAFETY RULES FOR PORTABLE ELECTRIC HAND TOOLS

1. Permission of instructor must be obtained before using portable electric tools.

2. Be sure that the switch is in the "off" position before you "plug in" the electric cord.

3. Eye protection must be worn when operating <u>all</u> portable electric tools.

4. The switch on each equipment handle should be the constant pressure (dead-man) type. That is, when pressure is released, power is shut off.

5. Be sure that equipment is properly grounded - do not use in wet areas.

6. Do not wear loose or baggy clothing that could be caught in revolving parts.

7. Before starting, be sure that you have a good footing and that your work area if free of obstacles.

8. The electric cord should be inspected for breaks or exposed wires before using.

9. Excessive pressure while operating portable electric tools may damage the tool and cause an accident.

10. All work should be properly secured before applying the tool.

11. Guards should be inspected before starting to see that they function properly.

HOUSEKEEPING

Good housekeeping is a key item in accident prevention. It takes the cooperation of all; it can't be the responsibility of the instructor and custodian alone.

An effective housekeeping program will:

1. Reduce exposures to slips and falls.
2. Reduce fire hazards.
3. Remind individuals of their responsibilities in keeping the laboratory clean and orderly.
4. Organize the housekeeping effort so that everyone assumes his fair share of the task.

Good housekeeping cannot be accomplished by an occasional grand cleanup. A program must be developed for continual cleanup. The following are essential in a good housekeeping program:

1. The equipment is arranged to permit safe and efficient work practices.
2. Materials and supplies are neatly and safely stacked.
3. Sufficient waste containers are provided and used.
4. Floors are clean.
5. Combustible materials are properly disposed of or stored in approved containers.
6. Excess materials and debris are not allowed to remain on benches and in the work areas.
7. Regular inspections are made to maintain clean and orderly conditions.

Items that are necessary for good housekeeping in an Industrial Arts Laboratory are:

1. Adequate dust collecting system.
2. Suitable containers for scraps, shavings, chips, and other waste material.
3. Adequate storage rooms, shelves, racks, and cabinets for materials and supplies.
4. Splash guards and collecting pans for all machines using oil and coolants.
5. Brooms, bench brushes, shop towels, and other cleaning equipment.

<u>IT IS YOUR RESPONSIBILITY TO SEE THAT HOUSEKEEPING TOOLS, EQUIPMENT AND SUPPLIES ARE PROPERLY USED</u>.

SAMPLE SAFETY AGREEMENT

I agree to follow only those practices and procedures that are identified by the instructor as being safe. Furthermore, I agree not to use any machine in the lab until the instructor's approval is obtained. I also understand that no machine or portable electric tool is to be used unless the teacher is present.

At no time will I either distract or bother other students (or enter a machine operator's area) while a machine is being used. I further agree not to remove any guard without special permission from the instructor. In return, the instructor is expected to provide, as far as possible, a safe working place.

Signed _____

Date _____

SAFETY PROGRAMMING FOR THE TEACHER

As pointed out in the introduction to the Safety Guide, safety is not something that is "picked up" by experience.

Safety is a subject that must be taught and integrated with other disciplines in education.

The control of accidents within the shop and the development of student safety attitudes and awareness will involve good practices in the following areas:

Housekeeping practices 132

Housekeeping 132

Materials handling 133

Electrical safety 134

Fire safety 137

Personal protection 140

Lesson plan for eye safety in school and lab 141

Hearing protection 145

Respiratory protection 148

HOUSEKEEPING PRACTICES

1. Provide for the daily removal of all sawdust, shavings, metal cuttings and other waste material.

2. Provide properly marked boxes or bins for various kinds of scrap stock.

3. For materials storage, utilize sturdy racks and bins arranged to keep material from falling on students and to avoid injuries from protruding objects.

4. Employ a standard procedure to keep floors free of oil, water and foreign material.

5. Provide brushes for the cleaning of equipment after each use.

6. Provide regular custodial service in addition to end-of-class cleanup.

7. Prohibit the use of compressed air to clean clothing, equipment and work areas.

8. Keep walkways and work areas free of all obstructions.

9. Maintain floor surfaces in a "non-skid" condition.

10. Utilize a student personnel organization to insure total involvement in housekeeping and a more thorough cleanup.

HOUSEKEEPING

Good housekeeping is a key item in accident prevention. It takes the cooperation of all; it can't be the responsibility of the instructor and custodian alone. An effective housekeeping program will:

1. Reduce exposures to slips and falls,

2. Reduce fire hazards,

3. Remind individuals of their responsibilities in keeping the laboratory clean and orderly, and

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2. Suitable containers for scraps, shavings, chips and other waste material.

3. Adequate storage rooms, shelves, racks, and cabinets for materials and supplies.

4. Splash guards and collecting pans for all machines using oil and coolants.

5. Brooms, bench brushes, shop towels, and other cleaning equipment.

<u>It is your responsibility to see that housekeeping tools, equipment, and supplies are properly used</u>.

MATERIALS HANDLING

According to the National Safety Council, nearly one in four disabling injuries is directly related to materials handling activities. These accidents include such things as slips and falls while carrying objects, back injuries and hernias from improper lifting practices, chemical and heat burns from failure to use protective clothing or equipment, and mashed or amputated fingers or toes from dropped objects.

Some of the things you can do to reduce the chance of injury to yourself or others when handling materials are:

1. Use the proper aids to handle the materials, such as tongs for hot materials, block and tackle or jacks to lift extra heavy items, and blocks or wedges to keep items from rolling.

2. Don't try to lift heavy objects without help; before you lift make clear who is giving orders.

3. Use proper lifting techniques.

4. If the material is heavy or sharp use gloves or pads to insure a better grip or to avoid cuts. Be careful of splinters when handling lumber; wear gloves to handle rough lumber.

5. Before you pick up an object, be sure that the path you intend to follow is clear.

6. With heavy objects, make a "first lift" before carrying it so that you can get the feel and position.

7. With long objects, such as pipe or ladders, have someone at each end so that these objects can be safely guided.

8. Be careful not to drop or set heavy objects on your feet or those of other people.

9. Stack materials so that there is no danger of their slipping or falling during storage or removal.

ELECTRICAL SAFETY

The use of electricity has become so common that few people realize the potential dangers of electrical energy. Most of the accidents that are caused by electricity could have been avoided if the hazard had been recognized and if action had been taken to correct the adverse condition.

The instructor must realize that any electrical circuit is a potential hazard, regardless of the amount of voltage or current present.

The nature of the injury may be affected by the frequency of the current and the kind of electrical energy. Direct current is usually considered less hazardous than alternating current as far as shock is concerned, but is more likely to produce severe burns and tissue damage. The physical condition of the victim is another factor which has a bearing on the severity of electrical shock.

Electrical accidents are caused by unsafe conditions, unsafe practices, or a combination of both.

A study of accidents in the State of California reveals that "unsafe practices were reported in four out of five accidents. Using unsafe or defective tools or equipment led the list, while failure to de-energize equipment, using tools or equipment in an unsafe manner and working in hazardous places were next in order."

Causes of electrical accidents can be traced to (1) defective equipment, (2) unsafe work practices, and (3) lack of knowledge of the dangers of electricity.

1. Defective Equipment: Types of equipment frequently involved in electrical accidents include motor-driven equipment, control devices, portable electric tools, switches, panels, cutouts, conductors, plugs and fuses, and electric extension cords. A variety of unsafe conditions involving the different types of equipment creates many electrical hazards. Some of the common defects of tools and equipment are listed as follows:

   a. Improperly grounded equipment (ground wires missing, broken or improperly connected).

   b. Open conduits, switch boxes, damaged or worn connections, and exposed live wires.

   c. Insulation which is defective, inadequate, worn frayed, wet, oily or deteriorated, creating short circuit possibilities and energizing equipment frames.

   d. Defective switches, receptacles, extension cords, and lamp sockets.

   e. Dirty motor windings, improperly adjusted brushes, and worn commutators.

   f. Improperly connected power tools and defective insulation in portable tools.

   g. Broken housings, loose or vibrating machine parts which might contact and energize tool or machine frames and expose "live" surfaces to operator.

2. Unsafe Practices: Unsafe practices and work procedures result in electrical accidents and fires. Some of the common unsafe acts committed in the shop are:

   a. Using ungrounded equipment and portable tools (except double insulated tools) or removing ground connections.

   b. Using defective tools or equipment in need or repair.

c. Using equipment which does not meet the approval of the Underwriters Laboratories for the intended use.

d. Unsafe cleaning of electrical panels, switch boxes, motors, and other electrical equipment with water or dangerous solvents.

e. Overloading of circuits or overfusing circuits by the use of wrong size or type of fuse.

f. Failure to use explosion-proof or other special wiring methods in hazardous locations.

g. Failure to positively lock out or otherwise de-energize and tag equipment or circuits to be worked on. Do not rely on gloves, rubber mats, etc., for electrical installation and repair.

h. Installation or extension of electrical facilities in a manner not meeting the National Electrical Code.

i. Repeated closing of switches or circuit breakers when there is a fault on the circuit.

j. Using light duty, ungrounded extension cords for industrial service.

k. Failure to maintain clear access to electrical panels. Clearance of 30 inches is required by Federal Code.

l. Use of extension cords in place of permanent wiring extensions.

m. Work practices which overload motors, insulation, wires or electrical accessories.

n. Disconnecting electric cord by pulling on the cord rather than on the plug.

o. Use of metal ladders while working on electrical equipment.

p. Failure to label switch panels and boxes.

3. Lack of knowledge: Teaching a basic understanding of electrical safety is part of an Industrial Arts Educational Program. Ground Fault Protection is a recent development that can save lives. Devices are now readily available which give sure protection against electrocution or serious shock from defective portable tools or cords. Their use should be encouraged in all areas, but particularly where there is a serious shock hazard from wet conditions or other conditions causing massive grounding of the student.

In summary, an adequate program for the prevention and elimination of electrical hazards must rest upon:

a. Intelligent selection and purchase of equipment.

b. Correct installation of equipment.

c. Education of students in the safe use of electrical energy.

d. Periodic inspection of equipment.

e. Regular maintenance.

FIRE SAFETY

1. Provide approved fire extinguisher in the shop area. Multi-purpose dry chemical units are most effective for general use. General purpose fire extinguishers should have at least a 2A:10 BC rating. Water back-up for extinguishers is always desirable. Multi-purpose dry chemical can damage delicate electrical equipment. CO_2 type extinguishers eliminate that problem.

2. Store flammable liquids in approved (Underwriters Laboratories or Factory Mutual labeled) safety containers and cabinets.

3. Provide for the bulk storage of flammable materials in an area removed from the main school building.

4. Provide Underwriters Laboratories listed oily waste containers for oily and paint soaked rags. It is a good policy to place waste with high spontaneous combustion potential in water filled containers. (See National Fire Protection Association Pamphlet 30, para. 4450, "Flammable and Combustible Liquids Code.")

5. Provide for the inspection and testing of fire extinguishers at regular intervals to ascertain that they are fully charged and in proper working condition. (See National Fire Protection Pamphlet 10, "Standards for Portable Fire Extinguishers" for details.)

6. Provide instruction to students in the location and proper use of fire extinguishers and other fire fighting equipment.

7. Segregate oxidizers and oily material in storage. Do not use oxidizer (peroxide catalyst) containers for other purposes.

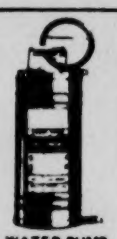
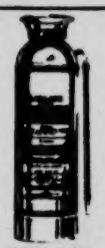
8. Post fire alarm and evacuation procedures.

9. Students should know remote shut-off valve or switch locations for gas or oil fired equipment and how to de-energize electrical equipment in an emergency.

10. Deluge showers would be desirable in all Industrial Arts laboratories, especially where there is danger of fire igniting clothing made of synthetic materials.

11. An approved fire blanket should be provided in each laboratory.

KNOW YOUR FIRE EXTINGUISHERS

	WATER TYPE				FOAM	CARBON DIOXIDE	DRY CHEMICAL			
							SODIUM OR POTASSIUM BICARBONATE		MULTI-PURPOSE ABC	
	STORED PRESSURE	CARTRIDGE OPERATED	 WATER PUMP TANK	 SODA ACID	FOAM	CO 2	CARTRIDGE OPERATED	STORED PRESSURE	STORED PRESSURE	CARTRIDGE OPERATED
CLASS A FIRES — ORDINARY COMBUSTIBLES — WOOD, PAPER, TRASH HAVING GLOWING EMBERS	YES	OBSOLETE — UPDATE YOUR FIRE EXTINGUISHING CAPABILITY— ASK FOR "TRADE-IN UPDATE" PRICE	YES	OBSOLETE — UPDATE YOUR FIRE EXTINGUISHING CAPABILITY— ASK FOR "TRADE-IN UPDATE" PRICE	OBSOLETE — UPDATE YOUR FIRE EXTINGUISHING CAPABILITY— ASK FOR "TRADE-IN UPDATE" PRICE	NO (BUT WILL CONTROL SMALL SURFACE FIRES)	NO (BUT WILL CONTROL SMALL SURFACE FIRES)	NO (BUT WILL CONTROL SMALL SURFACE FIRES)	YES	YES
CLASS B FIRES — FLAMMABLE LIQUIDS — FLAMMABLE LIQUIDS, GASOLINE, OIL, PAINTS, GREASE, ETC.	NO		NO			YES	YES	YES	YES	YES
CLASS C FIRES — ELECTRICAL EQUIPMENT — ELECTRICAL EQUIPMENT	NO		NO			YES	YES	YES	YES	YES
CLASS D FIRES — COMBUSTIBLE METALS — COMBUSTIBLE METALS	SPECIAL EXTINGUISHING AGENTS APPROVED BY RECOGNIZED TESTING LABORATORIES									
METHOD OF OPERATION	PULL PIN-SQUEEZE HANDLE	OBSOLETE — UPDATE YOUR FIRE EXTINGUISHING CAPABILITY— ASK FOR "TRADE-IN UPDATE" PRICE	PUMP HANDLE	OBSOLETE — UPDATE YOUR FIRE EXTINGUISHING CAPABILITY— ASK FOR "TRADE-IN UPDATE" PRICE	OBSOLETE — UPDATE YOUR FIRE EXTINGUISHING CAPABILITY— ASK FOR "TRADE-IN UPDATE" PRICE	PULL PIN-SQUEEZE LEVER	RUPTURE CARTRIDGE-SQUEEZE LEVER	PULL PIN-SQUEEZE HANDLE	PULL PIN-SQUEEZE HANDLE	RUPTURE CARTRIDGE-SQUEEZE LEVER
RANGE	30' - 40'		30' - 40'			3' - 8'	5' - 20'	5' - 20'	5' - 20'	5' - 20'
MAINTENANCE	CHECK AIR PRESSURE GAUGE MONTHLY		DISCHARGE AND FILL WITH WATER ANNUALLY			WEIGH SEMI-ANNUALLY	WEIGH GAS CARTRIDGE-CHECK CONDITION OF DRY CHEMICAL ANNUALLY	CHECK PRESSURE GAUGE AND CONDITION OF DRY CHEMICAL ANNUALLY	CHECK PRESSURE GAUGE AND CONDITION OF DRY CHEMICAL ANNUALLY	WEIGH GAS CARTRIDGE-CHECK CONDITION OF DRY CHEMICAL ANNUALLY

NOTES:

Class D Fires - In hot metal areas which may utilize magnesium, titanium, zirconium & sodium must provide Type D extinguishers or D rated dry chemical available for use on metal fires.

It is important that the correct extinguisher is used on the proper class of fire.

PERSONAL PRACTICES AND CONDUCT

Accident prevention is up to you. There are certain basic rules of conduct that you should incorporate into your daily activities. These rules all involve your attitude toward your fellow worker as well as your attitude toward the task at hand. People with a poor job attitude are those that most frequently have accidents.

Orderliness is a desirable quality. Safe workers will have a methodical approach to the job. They will lay out tools neatly so that they are able to approach the project in an orderly manner. They will not clutter up their work area with excessive tools and materials.

A safe worker is a clean worker. Messy jobs require continual cleanup of the work area and frequently of the worker.

Horseplay in the laboratory will not be tolerated. Severe accidents often have occurred because individuals:

1. Threw items in the laboratory.
2. Ran in the laboratory.
3. Lacked consideration for others.
4. Directed compressed air toward others.
5. Played tricks on others -- hot metal, electrical shock, glue in pockets, etc.
6. Did not adhere to the accepted safe practices of a laboratory environment.

PERSONAL PROTECTION

1. Head
   a. Confine long hair so that it is not exposed to machinery.
   b. Provide hard hat where appropriate.
2. Eye- Face

   Require the wearing of appropriate safety equipment where there is danger of injury. (See *ANSI Eye Protection Chart.)

*American National Standards Institute

3. Respiratory

   a. Provide respirators for student use where harmful dusts or fumes exist. (See Respiratory guidelines.)

   b. Ensure adequate ventilation for dusts, fumes, and vapors.

4. Body Protection

   a. Prohibit the wearing of loose clothing in the laboratory.

   b. Require students to remove rings and other jewelry while working in the laboratory.

   c. Provide leggings and foot protection, armlets, gloves, aprons, and shields when working with molten material.

   d. Make certain that the appropriate protective clothing is used when handling harsh materials that would cause chemical burns or lacerations.

5. Hearing

   a. Where noise levels are excessive over long periods of time, ear protection should be worn.

   b. Engineering solutions should be sought out to remedy excessive noise problems.

   c. Monitor noise levels with a Type 2A noise level meter.

6. Personnel Protection Cautions

   a. Determine the physical defects and limitations of all students so that they will not be assigned tasks detrimental to their health or physical condition.

   b. Where asbestos protective garments could be detrimental to the health of the wearer, substitute an alternate protective fabric, or use asbestos which is treated to reduce shedding.

EYE PROTECTION

1. The State Department of Education, Industrial Arts Section, strongly suggests protection programs be developed and implemented in all areas where there are activities potentially hazardous

to the eye. A procedure for adoption by school parishes is as follows:

a. All administrators and teachers shall assess the eye exposure for which they are responsible, and recommend the appropriate protection. This recommendation shall protect students, staff members, and visitors. (See Selection Chart-American National Standards Institute Z87 .1-1968.)

b. It is the responsibility of Industrial Arts instructors to see that eye protection is worn at all times in those areas that have been identified as exposure areas.

c. Eye protection shall be supplied and maintained by the parish and loaned at no cost to students, staff members and visitors.

d. To insure the effectiveness of the eye protection program, the physical inspection and periodic review of the eye safety program shall be the reaponsibility of a designated parish administrator.

Reference is also made to "American National Standard Practice for Occupational and Educational Eye and Face Protection," ANSI Z87 .1-1968.

This program shall be rigidly enforced and monitored by all concerned. There should be no deviation from the program once it is accepted and put into use.

2. Students who require corrective lenses shall be encouraged to obtain prescription safety glasses. When plain prescription glasses are worn, the student should be required also to wear an appropriate cover goggle.

   Caution: Most shatter-resistant glasses do not meet the standard of ANSI and many "safety glasses" also fail the tests and design features listed.

3. Storage and sanitation facilities shall be provided within the classroom for all eye protection. School districts have found that they had better eye protection programs when individual glasses had been provided for each student enrolled in the Industrial Arts class.

   Good eye protection devices require clean lenses. Lenses shall be cleaned daily.

8. Potential Hazards From Light Ray and Glare:

a. The light rays cast from welding and cutting operations can be highly injurious to unprotected eyes. Heat treating, metal pouring, steel and glass furnaces and laser beams are other sources of glare.

b. In gas welding, cup type welding goggles with green filter lenses are most commonly used .

c. For electric welding, helmets are necessary to protect the head and eyes from infra-red and ultra-violet radiation burns, hot metals, chips and flying sparks.

d. Contact lenses present specific hazards in the laboratory setting. The use of contact lenses should be discouraged in the lab.

e. Photocromatic and phototropic (photosun-photogray) lenses may not be worn as protective eyewear where hazardous infra-red or ultra-violet radiation is present.

Selection Chart

Recommended Eye and Face Protectors for Use in Industry, Schools, and Colleges

1. GOGGLES, Flexible Fitting, Regular Ventilation
2. GOGGLES, Flexible Fitting, Hooded Ventilation
3. GOGGLES, Cushioned Fitting, Rigid Body
*4. SPECTACLES, Metal Frame, with Sideshields
*5. SPECTACLES, Plastic Frame, with Sideshields
*6. SPECTACLES, Metal-Plastic Frame, with Sideshields
** 7. WELDING GOGGLES, Eyecup Type, Tinted Lenses (Illustrated)
7A. CHIPPING GOGGLES, Eyecup Type, Clear Safety Lenses (Not Illustrated)
** 8. WELDING GOGGLES, Coverspec Type Tinted Lenses (Illustrated)
8A. CHIPPING GOGGLES, Coverspec Type, Clear Safety Lenses (Not Illustrated)
** 9. WELDING GOGGLES, Coverspec Type, Tinted Plate Lens
10. FACE SHIELD (Available with Plastic or Mesh Window)
**11. WELDING HELMETS

*Non-sideshield spectacles are available for limited hazard use requiring only frontal protection.
**See appendix chart "Selection of Shade Numbers for Welding Filters."

APPLICATIONS		
OPERATION	HAZARDS	RECOMMENDED PROTECTORS: Bold Type Numbers Signify Preferred Protection
ACETYLENE–BURNING ACETYLENE–CUTTING ACETYLENE–WELDING	SPARKS, HARMFUL RAYS, MOLTEN METAL, FLYING PARTICLES	**7, 8, 9**
CHEMICAL HANDLING	SPLASH, ACID BURNS, FUMES	**2, 10** (For severe exposure add 10 over 2)
CHIPPING	FLYING PARTICLES	**1, 3, 4, 5, 6, 7A, 8A**
ELECTRIC (ARC) WELDING	SPARKS, INTENSE RAYS, MOLTEN METAL	**9, 11** (11 in combination with 4, 5, 6, in tinted lenses, advisable)
FURNACE OPERATIONS	GLARE, HEAT, MOLTEN METAL	**7, 8, 9** (For severe exposure add 10)
GRINDING–LIGHT	FLYING PARTICLES	**1, 3, 4, 5, 6, 10**
GRINDING–HEAVY	FLYING PARTICLES	**1, 3, 7A, 8A** (For severe exposure add 10)
LABORATORY	CHEMICAL SPLASH, GLASS BREAKAGE	**2** (10 when in combination with 4, 5, 6)
MACHINING	FLYING PARTICLES	**1, 3, 4, 5, 6, 10**
MOLTEN METALS	HEAT, GLARE, SPARKS, SPLASH	**7, 8** (10 in combination with 4, 5, 6, in tinted lenses)
SPOT WELDING	FLYING PARTICLES, SPARKS	**1, 3, 4, 5, 6, 10**

HEARING CONSERVATION PROGRAMS

The OSHA noise regulations are brief - a little over one column - but far-reaching. Basically, there are two sections: the first sets the maximum levels of noise to which a person may be exposed; the second section explains what action must be taken if these noise levels are exceeded.

The key part of the OSHA standard is the Permissible Noise Exposure Table. It sets the amount of time that a person may be exposed to various levels of sound, as measured in decibels or dB.

The basic standard permits a person to work eight hours a day on a job where steady state noise does not exceed 90dB as measured on the A-scale of a standard sound level meter at slow response. Many people believe that protection should start at 85dB (A). For this reason OSHA decided in August 1973 to make Hearing Conservation Programs (medical surveillance) mandatory whenever steady-state noise exposure exceeds 85dB. For any period of exposure to impulsive or impact noise, a 140dB peak reading may not be exceeded.

TABLE G-16
Permissible Noise Exposure Table

Duration per day, hours:	Sound Level dba
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4	115

There are three basic approaches to noise control and the method of control must be approached in the following order.

1. Reducing noise at its source through administrative and engineering controls.

2. Providing hearing protection.

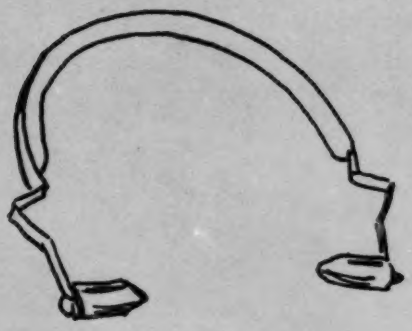
3. Carrying out a program of hearing conservation.

CHART OF SELECTED NOISE SOURCES

NOISE LEVEL Sound Level Decibels	SOURCE	RISK
150	Jet Engine Test Cell	Uncomfortably
130	Riveting Steel Tank	Loud
120	Threshold of Pain	DANGER RANGE
112	Sand Blasting	
110	Drills, Steam Shovels, Trucks, Operating Riveting machines, Rock and Roll Band Circular Saw	Very Loud
100	Can Mfg. Plant Portable Grinders	
90	Portable Sanders Welding Equipment	RISK Range
75	Inside Sports Car(50 MPH)	Loud
40	Library	Quiet

If you do not have a Type 2A Sound Level Meter, contact a local industrial concern, or group of safety engineers.

The choice of hearing protective device should be left to the wearer. Remember, "the best hearing protector is the one that is worn."



Sound Ban - Air cushioned pads provide a seal at the entrance to the ear canal.

Muff - covers ear completely.

Plugs of the disposable type provide hygienic effective protection.

RESPIRATORY PROTECTION

1. It is vital that appropriate respiratory devices be provided to a student who is exposed to hazardous substances.

   A. Consult the respiratory protection guideline.

   B. Request assistance from a local Safety Council member when in doubt as to the respirator which is appropriate, or when in doubt as to the concentrations present and the sufficiency of a standard type respirator.

2. Clean respirators must be provided, especially if devices are used by several students.

3. Ventilation of dust, fumes, and vapors should be undertaken when possible.

4. If any student suffers from a respiratory illness, his doctor should be consulted to determine if that student can utilize a respirator for protective purposes, or be involved in activities where exposure is a possibility.

RESPIRATOR PROTECTION SHOULD BE CAREFULLY SELECTED FOR EACH SPECIFIC APPLICATION, AND SHOULD NOT BE WORN IN ATMOSPHERES IMMEDIATELY DANGEROUS TO LIFE OR HEALTH, OR IN ATMOSPHERES CONTAINING LESS THAN 19.5% OXYGEN. WEARER SHALL BE FITTED ACCORDING TO THE INSTRUCTIONS SUPPLIED BY THE MANUFACTURER, AND RESPIRATORS MAINTAINED ACCORDINGLY.

RESPIRATORY PROTECTION
GUIDELINE

WORK AREA	HAZARD	NIOSH CERTIFICATION		RESPIRATOR TYPE
WOOD WORKING	NUISANCE DUST	TC-21C DISPOSABLE		APPROVED FOR PNEUMONCONIOSIS AND FIBROSIS DUSTS
METAL GRINDING CERAMIC POLISHING	NUISANCE AND TOXIC DUSTS	TC-21C TYPE WITH DUST REPLACEABLE		APPROVED FOR DUSTS AND MIST
SPRAY PAINTING	ORGANIC VAPORS PAINT SPRAYS PATRICULATES	FILTER TC-23C CHEMICAL CARTRIDGE AND REPLACEABLE FILTER COMBINATION		APPROVED FOR ORGANIC VAPORS, DUSTS, MIST, PAINT, LACQUER AND ENAMEL MIST
PRINT SHOP	ORGANIC VAPORS AND TOXIC	TC-23C CHEMICAL CARTRIDGE AND REPLACEABLE FILTER COMBINATION		APPROVED FOR ORGANIC VAPORS AND/OR DUSTS MISTS
DRAFTING	AMMONIA VAPORS	TC-23C CHEMICAL CHEMICAL CARTRIDGE TYPE		APPROVED FOR AMMONIA VAPORS
JEWELRY ETCHING AND CLEANING	ACID GASES METAL FUMES	TC-23C CHEMICAL CARTRIDGE COMBINATION TYPE		APPROVED FOR ACID GASES OR METAL FUMES
MELT SHOPS WELDING SHOPS	BRASS, IRON AND OTHER METAL FUMES, AGENTS	TC-21C REPLACEABLE DUST MIST - FUME FILTER		APPROVED FOR METAL FUMES
AGRICULTURE	PESTICIDES	TC-23C CHEMICAL CARTRIDGE AND REPLACEABLE FILTER COMBINATION		APPROVED FOR PESTICIDES

EMERGENCY ACTION

Emergency situations can arise anywhere in the school environment and the procedures for dealing with these events should be developed and approved by the individual administrative unit (parish) prior to the start of the school year. These procedures should be reviewed and revised periodically to determine their effectiveness and to make necessary modifications.

The following information is provided to serve as a guide for the parishes to develop their own emergency procedures.

When an Injury Occurs 151

Primary Concerns 151

Secondary Concerns 152

WHEN AN INJURY OCCURS

There are two aspects of emergency procedures. The first concern is the activity that must take place immediately following the injury. The second concern is the action that must be taken after the confusion has subsided and the injured party is treated.

PRIMARY CONCERNS

These relate directly to the injured party and the reduction of hazard to that person. The degree of emergency care is dependent on the injury and the qualifications of the person administering the care. If the teacher is not qualified in first aid, he/she must do only the things that will assure no further damage to the injured person and immediately seek trained help. This might be limited to stopping the bleeding or covering a person in shock with a blanket. Although every teacher should be trained in basic emergency first aid, many are not. Serious damage to injured persons can sometimes result if they are treated by a nervous, untrained, and panic-ridden teacher. The following basic steps are recommended as the first steps when an injury occurs:

1. Determine the extent and type of injury. If this is not possible, immediately obtain professional help.

2. Restore breathing, restore heartbeat, and stop bleeding if trained in these areas; if not, send for help.

3. Apply only the first aid that is necessary to preserve life. Do no more until trained help arrives.

4. Disperse crowd and keep injured and the surrounding area as quiet as possible.

5. Notify school nurse (if any), principal, and immediate supervisor by sending other students to these people. DO NOT LEAVE THE INJURED PERSON ALONE!

6. If the injury is minor (splinter, slight cut) send the student to the school nurse or school official accompanied by another student. DO NOT SEND THE INJURED STUDENT ALONE!

7. If a foreign particle has entered the eye, seek professional help. A teacher should never try to remove something from a student's eye. If a liquid has entered the eye (acid, etc.), immediately wash and contact the school nurse or family doctor.

8. Notify parents and school officials.

It is the responsibility of the teacher to know what to do in case of an accident and also to know what not to do. This kind of information is best obtained through a variety of first aid courses offered through the Red Cross or other agencies. The first few seconds or minutes of a pupil's injury are sometimes the most critical and the action or inaction that the Industrial Arts teacher may take could be crucial to the student's life.

SECONDARY CONCERNS

When the injured student has been administered professional help (nurse, ambulance crew or doctor), the concerns of the teacher are focused on the remaining students and the follow-up procedures in regard to the injury. Some action is necessary in the following areas:

1. Calm the other members of the class. Restore the situation to a safe environment. If the accident was serious, discontinue instruction for the period. The students will be too upset to perform effectively and may in fact be "accident prone" due to the accident.

2. Complete accident report in triplicate; one for school nurse, one for the principal and immediate supervisor, and one for the teacher's permanent file (to be retained until the injured pupil reaches age 21 or if the pupil is a special education student, to be retained permanently).

3. Analyze cause and effect of the accident and make written recommendations to the principal for corrective measures to be taken. (Retain a copy of this communication and subsequent action.)

4. Review and record safety practices, procedures, instruction, and student evaluation concerning the cognitive, psychomotor, and affective instruction that was delivered and was intended to prevent this type of accident from happening.

5. Check on the results of the treatment of the injured pupil.

6. Follow up in your classes with a discussion and instruction regarding the safe practices that were violated and contributed to the accident.

The procedures mentioned should also be followed for "almost accidents" to assure that the conditions that almost cause an accident are treated and eliminated from the laboratory environment.

INDUSTRIAL ARTS DEPARTMENT

Student Accident Report

TO BE COMPLETED BY INSTRUCTOR

Student Name _____ Grade _____

Location of Accident _____

Time _____ A.M./ _____ P.M.

Date of Accident _____

Description of Injury _____

_____

Location of Instructor when Accident Occurred: _____

Description of How Accident Happened: _____

_____

Indicate Equipment, Machinery, or Tools Involved: _____

_____

Describe unsafe practices, if any, contributing to accident: _____

_____

Suggestions for prevention of similar accident: _____

_____

Witnesses to Accident: 1. _____

2. _____

Instructor's Signature _____ Date _____

Student's Signature _____ Date _____

NOTE: One copy to be filed with Department Chairman

STUDENT ACCIDENT INVESTIGATION REPORT

Class_____ Period_____ Room_____

Instructors's Name_____

Name of Injured_____ Date & Time_____

Exact Location of Accident_____

Description of Accident*_____

_____

Indicate below with an "X" whether in your opinion accident was caused by one of the following:

PHYSICAL CAUSES

( ) Improper protection (personal or equipment)
( ) Defective tools or equipment
( ) Hazardous arrangement
( ) Improper illumination
( ) Poor housekeeping
( ) Not listed - describe briefly*

_____

_____

PERSONAL CAUSES

( ) Physical or mental defect
( ) Lack of knowledge or skill
( ) Wrong attitude
( ) Use of intoxicants or drugs
( ) Not listed - describe briefly*

_____

_____

UNSAFE ACTS

( ) Working without authority
( ) Failure to secure or warn
( ) Working at unsafe speed
( ) Made safety device inoperative
( ) Used unsafe equipment or hands instead of equipment
( ) Not listed - describe briefly*

( ) Unsafe material handling
( ) Took unsafe position
( ) Worked on moving equipment
( ) Horseplay
( ) Did not use safe clothes or personal protective equipment

_____

_____

NOTE: Make certain of names and descriptions of witnesses, injured sent to hospital, condition of injured, assistance by others, etc.

Actions taken to prevent a similar future accident*_____

_____

Date of Report_____ Signature_____

*USE OTHER SIDE OF SHEET IF NECESSARY

STUDENT SAFETY INSPECTION CHECK LIST

Class _____ Period _____ Date _____

Hazardous conditions and unsafe acts should be reported so corrective action can be taken. Note also whether potential accident causes, marked "X" on previous inspection, have been corrected.

( ) indicated Satisfactory

(X) indicates Unsatisfactory

A. FIRE PROTECTION
1. Extinguishing equipment.... ( )
2. Exits, stairs and signs..... ( )
3. Storage of flammable material..... ( )
4. _____ ( )

B. HOUSEKEEPING
1. Aisles, stairs & floors..... ( )
2. Storage & piling of material..... ( )
3. Wash & locker rooms ..... ( )
4. Light and ventilation..... ( )
5. Disposal of waste..... ( )
6. _____ ( )

C. TOOLS
1. Power tools, wiring..... ( )
2. Hand tools..... ( )
3. Use & storage of tools..... ( )
4. _____ ( )

D. PERSONAL PROTECTIVE EQUIPMENT
1. Safety glasses or goggles... ( )
2. Face shields..... ( )
3. Gloves..... ( )
4. Respirators or gas masks.... ( )
5. Protective clothing..... ( )
6. _____ ( )

E. MATERIAL HANDLING EQUIPMENT
1. Winches..... ( )
2. Cranes, hoists, booms..... ( )
3. Carts..... ( )
4. Cables, ropes, chains, slings..... ( )
5. Rigging..... ( )
6. _____ ( )

SIGNED _____

USE OTHER SIDE OF SHEET FOR DETAILED COMMENTS OR RECOMMENDATIONS

F. BULLETIN BOARDS
1. Neat and attractive.....( )
2. Display changed regularly..( )
3. Well illuminated.....( )
4. _____( )

G. MACHINERY
1. Point of operation guards..( )
2. Belts, pulleys, gears, shafts, etc.....( )
3. Maintenance & oil leakage..( )
4. _____( )

H. PRESSURE EQUIPMENT
1. Steam equipment.....( )
2. Air compressors.....( )
3. Gas cylinders and hoses....( )
4. _____( )

I. UNSAFE PRACTICES
1. Improper lifting.....( )
2. Improper use of protective equipment.....( )
3. Horseplay.....( )
4. Running in aisles.....( )
5. Improper use of air hoses..( )
6. Removing machine guards....( )
7. Work on unguarded machinery( )
8. _____( )

J. FIRST AID
1. First aid kits.....( )
2. Stretchers.....( )
3. All injuries reported.....( )
4. _____( )

K. MISCELLANEOUS
1. Acids and caustics.....( )
2. New processes.....( )
3. Dusts, vapors or fumes.....( )
4. Ladders and scaffolds .....( )
5. _____( )

HAZARDOUS CONDITIONS REPORT

This is a suggested method for reporting the hazard and directing action to see that the hazard is corrected or removed.

If a hazard exists, the operation should be "red tagged" and shut down until corrected. NOTE: This form can be used to report a student who is a hazard as well as a hazardous condition in the laboratory.

HAZARDOUS CONDITIONS FORM

Date_____

TO:_____
Principal School

Description and Location of Health or Safety Hazard:_____

_____

_____

Suggested Solution:_____

_____

_____

Teacher Signature:_____

Distribution: Original - Principal
1st Copy - Department Head
2nd Copy - Teacher Reporting Hazard
3rd Copy - Parish Safety Officer (Vocational Supervisor)

Action Taken:_____

_____

_____

By Whom:_____
Signature

SAFETY FOR DEVELOPMENTALLY DISABLED AND HANDICAPPED STUDENTS

GENERAL STATEMENT

The responsibility for safe working conditions in a school laboratory is the prime concern of the teacher and all the students who work in the facility. With this in mind, the instructor of Industrial Arts subjects should make a special effort to teach safety to the disadvantaged and handicapped students enrolled in his or her program. Many special students such as these will need added instruction in safety with emphasis on personal responsibility to themselves and others with whom they work. Initially, instruction should be given in a classroom setting for a short period using an abundance of visual aids to explain proper safety procedures. Small group demonstrations can also be very effective while using the actual machines and tools. Individual instruction should actually use the equipment in the laboratory. In addition, safety reviews should be repeated at intervals to help reinforce safety procedures.

Industrial Arts teachers must be alert at all times during the working sessions for unsafe conditions and actions by the special students, and should be ready to take remedial steps if needed. Other sections of this manual list specific safety procedures and lessons that the teacher should follow to instill safe working habits in the student with special needs.

SUGGESTED TEACHING TECHNIQUES

1. Be sure that eye protection is worn. Have the students remind each other that safety glasses must be worn.

2. Check out each student on the power tools that he or she is about to use. Review the safety rules from time to time with each student—especially after a vacation or prolonged absence of the student. Be sure to document the recurrence of this instruction.

3. Medical records should be checked to determine if any special students are subject to seizures, fainting spells, etc. If the teacher finds someone who has one of these conditions, he should give that individual additional monitoring while using all equipment.

4. Make students aware of the potential dangers of cleaning agents, cutting fluids, solvents, thinners, lubricants, etc.

5. Remind students periodically of the importance of keeping work areas clean and free of hazardous objects.

6. Usually there is not a problem of horseplay by special students in a shop class unless they are encouraged by other students. The amount of horseplay will depend on the professional personnel and the rules established for the laboratory. If students are kept busy and supervised, horseplay for the special student is no major problem.

7. Isolation of a special student when rules of the laboratory are violated has been found to be one of the most effective methods of discipline. Keeping the student separated from the rest of the group should last no longer than one class period.

8. Special students have a tendancy to wander about the laboratory area. They must understand that they have an area to which they are assigned and must stay there.

9. Testing of the special student's abilities should be done by continual observation by the teacher, and demonstration by the student. Evaluation should not be limited to tests requiring reading, writing, and comprehension.

10. The teacher should design jigs and fixtures that serve to promote a higher level of student success while using tools and machines.

11. Communication between teacher and student may be enhanced by using devices that improve reception and expression of information. Amplifying and magnifying stimuli, whether coming in or going out, are important considerations.

12. Individualize the program of instruction as much as possible to modify the instructional method to meet the needs of the student.

13. Plan to reserve a portion of your facility that can be made free from noise, physical stimuli, and visual stimuli. This may help those students who are easily distracted by them.

14. Minimize access barriers to sinks, tool cabinets, doorways, machines, workbenches, shelves, desks, etc.

15. Accept the child as he or she comes to you. Keep in mind that the student's success depends not only upon his or her own characteristics and abilities, but also upon the teacher's attitude and the quality of the learning environment.

16. Employ the aid of the special education resource people on your school staff. These people are specialists who can provide you with valuable information in dealing with the problems of the students with special needs who are enrolled in your program.

17. Keep in mind that students with special needs respond very favorably to frequent verbal praise and reinforcement. A non-reading "hands-on" environment may provide some real, positive feelings of success for them. They will be encouraged also by seeing their finished products.

18. Encourage heterogeneous grouping within the classroom. Placing the special student within a small group of students with various abilities will provide him with models for behavior in a laboratory or other industrial-type facility.

EMERGENCY TELEPHONE NUMBERS*
*Post by Phone

	NAME	TELEPHONE
Ambulance		
Fire Department		
Hospital (nearest)		
Doctor (nearest)		
Main Office		
School Nurse		
Medic I		
Poison Control Center		

EMERGENCY COMMUNICATIONS

Procedures established for emergency situations and accidents must contain the approved method of "who tells what to whom and when." To facilitate this communication, each Industrial Arts department should have a telephone with a direct outside line (for ambulance, fire, and police emergencies). In addition:

1. All students should know the location of the telephone and be familiar with the emergency procedures and numbers.

2. All personnel in the laboratory should have access to the telephone for emergency communications. (The telephone should not be locked in the teacher's office.)

3. Emergency procedures and police, ambulance and fire department numbers and the procedure for dialing an "outside" line should be posted at each telephone location.

PARENTAL PERMISSION AND ACKNOWLEDGEMENT

Parental acknowledgement of the student's activities and an awareness of the teacher's interest in the safety of the child is important. The teacher should express this interest at every opportunity.

At the beginning of each Industrial Arts course a "permission slip" should be sent home with the student for the parent's signature.

Do not misunderstand the main purpose of a "permission slip." For years, Industrial Arts teachers have used "permission slips" to be sent home and signed by the parents permitting their child to participate in the shop program. Many teachers believed that this "permission slip" relieved them of some or all of their responsibility and liability should an accident occur. IT DOES NEITHER OF THESE. The purpose of this type of communication is to:

1. Inform the parent of his/her child's participation in Industrial Arts type of activities.

2. Outline the safety instruction and procedures that are followed by the teacher and the parish.

3. Obtain from the parents relevant information regarding any health problems that may have a bearing on their child's performance.

4. List the name of the parents and telephone number(s) where they can be reached during school hours, and list the name of their family doctor.

NOTE: A card file on every student should be maintained in each Industrial Arts Laboratory.

An illustration of what this communication to the parents might look like is included on the following page.

PERMISSION SLIP
THE STUDENT AND SAFETY IN INDUSTRIAL ARTS

Louisiana Public School
Department of Industrial Arts

School_____ Teacher_____

TO:_____

_____ is enrolled in our Industrial Arts
(Name of Student)
program and will have the opportunity to use various tools and equipment. Appropriate instruction in the safe operation of these tools and equipment is given and close supervision in maintained at all times. Although every precaution is taken to prevent accidents, a certain risk is involved due to the nature of the experience, the age of the student, and the learning environment.

We are asking your cooperation in impressing upon your child the importance of being careful. This, we believe, will back up the instruction that is given in school.

We welcome your visit to our school and the Industrial Arts Department to see our program. These visits can be arranged by calling_____.

Thank you very much for your help and assistance in providing your child with the "real world" experience of Industrial Arts in a safe working environment.

I have read the attached communication and I understand the type of program that _____ is enrolled in. I will stress the safety
(Student's name)
aspects of the program to my child. I encourage my child to participate fully in this Industrial Arts program.

_____ _____
(Signature of Parent or Guardian) (Date)

Phone (Home)_____ (Work)_____

Please identify any health problems which may have a bearing on your child's participation in this class._____

_____

I agree to observe all safety rules and procedures for safe operation and conduct in the school Industrial Arts shop and will wear approved eye protection at all times.

_____ _____
Signature of Student Date

Color:

Colors should be used to create a pleasant work area (attitude) and to reduce glare. Light pastels are best for walls, partitions, and ceiling areas. There is no agreed standard for "color coding" machines or equipment, but use of different colors or shades of the same color is an excellent way to differentiate between various parts. This method can also be used to emphasize a hazardous area, point of operation or nip point, etc. Most equipment color suggestions would follow this basic ASA (American Standards Association) ZR53 color system:

Basic Unit	Gray or Green (by tradition)
Parts which may cut, crush or shock (guards)	Orange
Parts which move - or project (warning)	Yellow (or black and yellow stripes)
"Stop" Buttons or switches	Red
Unit under repair	Blue

Other color suggestions:

Fire alarm boxes, exit signs, fire extinguishers, barricade lights - danger signs	Red
First aid kits - stretcher equipment - safety signs	Green
Traffic zone markings	Black, white (or black and white stripes)
Housekeeping markings	Yellow, black and yellow

The personal system you choose must be standard throughout your laboratory. New equipment should be touched up or painted to match existing equipment.

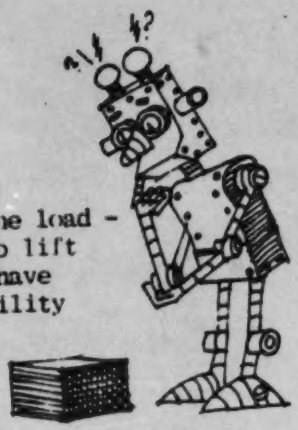
Safety consideration is a critical requirement of facility planning and can "pre-solve" many future safety problems.

We strongly suggest that all Industrial Arts instructors use this color guide for their labs within three years after distribution of this booklet.

Safe Lifting

1

First, size up the load - do not attempt to lift it alone if you have doubt in your ability to do so.



2

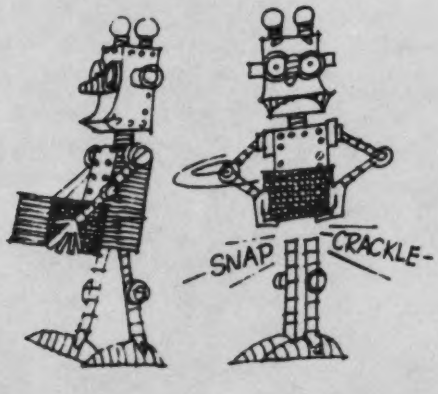
Make sure that your footing is secure. One foot may be forward of the other to attain good balance.

3

Bend the knees and squat (don't stoop) keeping the back as nearly vertical as possible. Spread the knees or lower one knee to get closer to the object.

4

Now start pushing up with your legs. Keep the load close to your body as you come up.



5

Lift the object to the carrying position. Do not twist the body. Turn your body by changing the position of the feet.

6

In lowering the load to the floor, bend the knees. Keep the back straight with the load close to the body, lowering the load with the arm and leg muscles.

MATERIALS HANDLING

According to the National Safety Council, nearly one in four disabling injuries is directly related to materials handling activities. These accidents include such things as slips and falls while carrying objects, back injuries and hernias from improper lifting practices, chemical and heat burns from failure to use protective clothing or equipment, and mashed or amputated fingers or toes from dropped objects.

Some of the things you can do to reduce the chance of injury to yourself or others when handling materials are:

1. Use the proper aids to handle the materials, such as tongs for hot materials, block and tackle or jacks to lift extra heavy items, and blocks or wedges to keep items from rolling.

2. Don't try to lift heavy objects without help; before you lift make clear who is giving the orders.

3. Use proper lifting techniques (see Page S-3.07).

4. If the material is heavy or sharp use gloves or pads to assure a better grip or to avoid cuts. Be careful of splinters when handling lumber; wear gloves to handle rough lumber.

5. Before you pick up an object be sure that the path you intend to follow is clear.

6. With heavy objects, make a "first lift" before carrying it so that you can get the feel and position.

7. With long objects, such as pipe or ladders, have someone at each end so that they can be safely guided.

8. Be careful not to drop or set heavy objects on your feet or those of other people.

9. Stack materials so that there is no danger of slipping or falling during storage or removal.

TEST QUESTIONS COVERING GENERAL SAFETY INSTRUCTION

( ) 1. You should report all injuries, even though slight, to: (a) an advanced student; (b) your principal; (c) your teacher; or (d) the office.

( ) 2. You should wear suitable eye protection: (a) to improve your vision; (b) when engaged in any activity where eye hazards may exist; (c) to avoid myopia; or (d) when you desire to improve your appearance.

( ) 3. It is best to fasten or remove loose clothing and roll sleeves above your elbows: (a) before operating any machine; (b) during the operation of the machine; (c) after operating a machine; or (d) only when you are assisting the teacher.

( ) 4. The designated area or operator's zone around a machine is to protect: (a) the power equipment; (b) all the students and the teacher working in the shop; (c) only the teacher; or (d) only the student operating the machine.

( ) 5. It is best that any liquid spilled on the floor should be wiped up immediately because it: (a) looks unsightly; (b) will stain the floor; (c) causes more work for the custodian; or (d) may cause someone to slip and injure himself.

( ) 6. Rags containing oil, gasoline, alcohol, shellac, paint, varnish, or lacquer must be: (a) kept in a covered metal container; (b) stored in a wastebasket; (c) folded neatly and placed on a shelf; or (d) stored in a cool dry place.

( ) 7. Before using any power equipment, you should obtain permission from: (a) an advanced student; (b) your principal; (c) your teacher; or (d) the office.

( ) 8. If you notice any breakage or damage to a tool, instrument, or machine, you should: (a) ask an advanced student to repair it; (b) be careful when you use it; (c) say nothing because you might be blamed; or (d) notify your teacher.

( ) 9. When using a knife, you should: (a) pull the knife toward you; (b) strike the blade with a hammer to make large cuts; (c) use pointed end only; or (d) cut away from your body and hands.

( ) 10. You should grind off a mushroomed head on a chisel or punch so as to prevent: (a) inaccuracies in your work; (b) spoiling the looks of the tool; (c) making the tool difficult to hold; or (d) particles of metal from flying when you strike the head with a hammer.

II

_____1. All the work that you plan to do should be approved by the _____.

_____2. You should clear away dry chips with a piece of wood or a _____.

_____3. When using a wood chisel or gouge, you should point the sharp edge of the tool away from your classmates, teacher and _____.

_____4. You should pass tools to classmates with the handles _____.

_____5. You should make sure that all students are clear of the machine before turning on the _____.

_____6. Before oiling, cleaning, or adjusting a machine, you should allow the machine to come to a complete _____.

Answers to Test Questions:

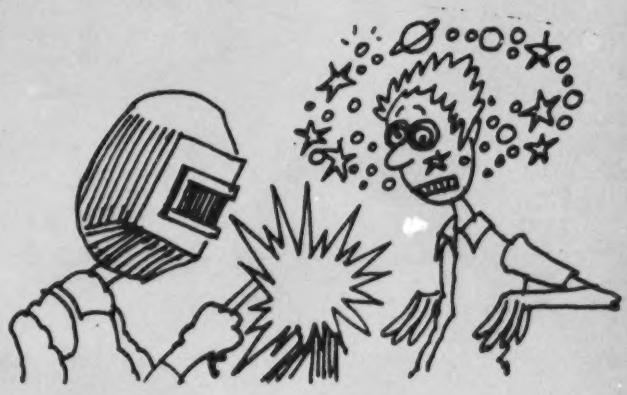
I. 1. (c); 2. (b); 3. (a); 4. (b); 5. (d); 6. (a); 7. (c); 8. (d); 9. (d); 10. (d)

II. 1. teacher; 2. brush; 3. self (yourself); 4. first; 5. power (switch); 6. stop

NOTE: REMEMBER, THESE ARE ONLY SUGGESTIVE TEST QUESTIONS. YOU MAY ADD OR DELETE THOSE PERTAINING TO YOUR PROGRAM.

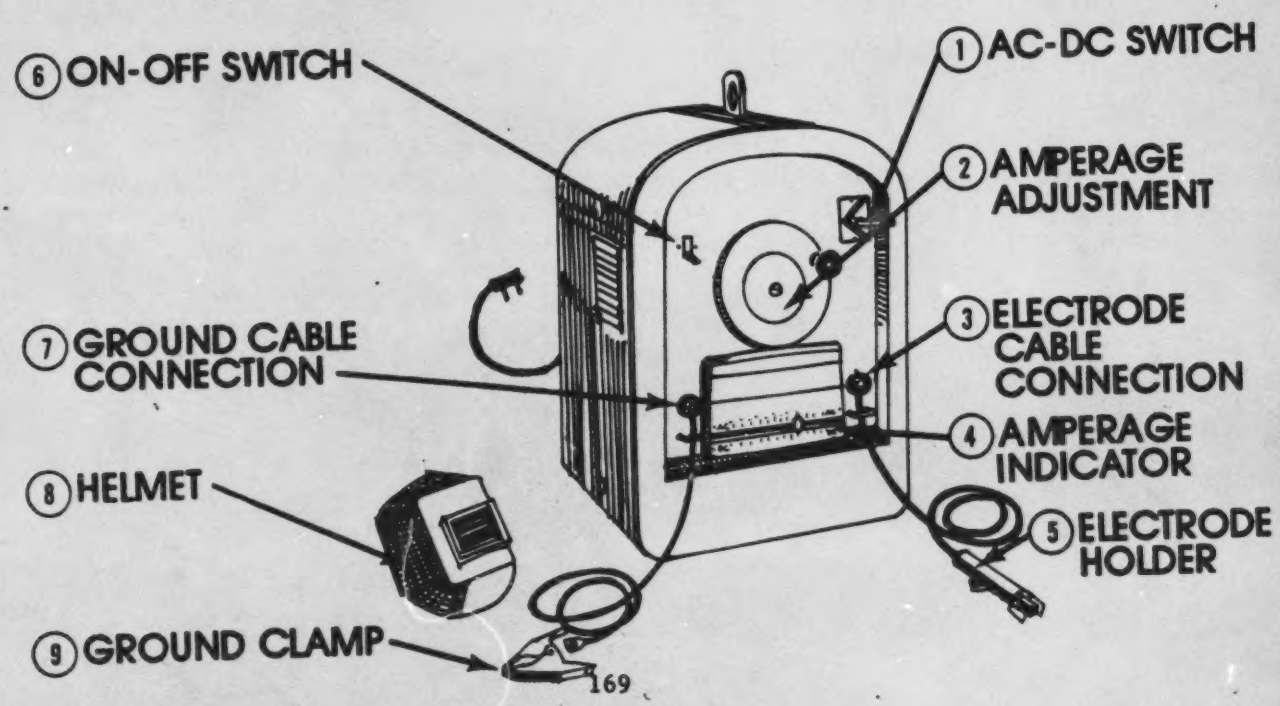
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Arc Welder



SAFETY SUGGESTIONS

1. A welding helmet must be worn when welding.
2. Proper ventilation must be available.
3. Goggles must be worn when chipping slag.
4. Others in the area must be warned prior to striking an arc.
5. Approved clothing and gloves must be worn when welding.
6. Closed containers should not be welded without the instructor's permission.
7. Do not stand in wet areas while welding.
8. Screens to protect others must be in place before welding is started.
9. Special caution should be taken when wearing contact lenses.



ARC WELDER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

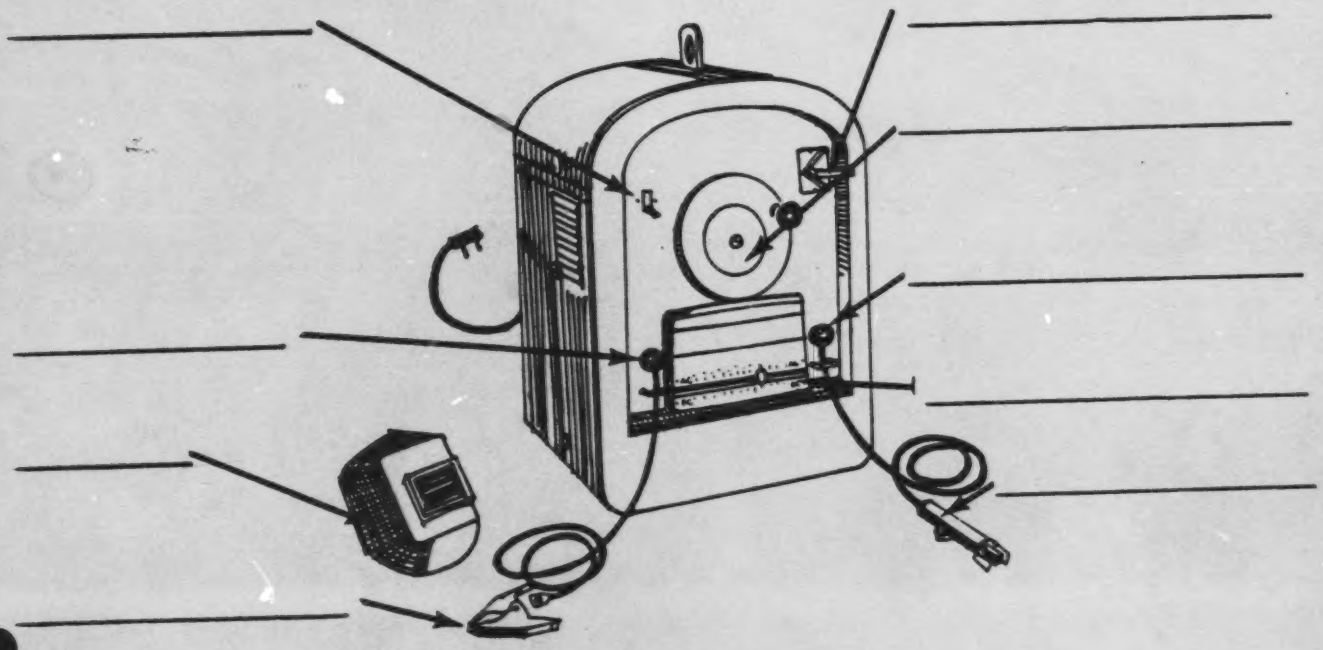
1. You should warn anyone nearby before you start to weld. T F

2. Approved goggles and a welding hood should be available before you start to weld. T F

3. A closed container is dangerous to weld. T F

4. Gloves are not necessary when welding. T F

5. It is dangerous to weld without proper ventilation. T F

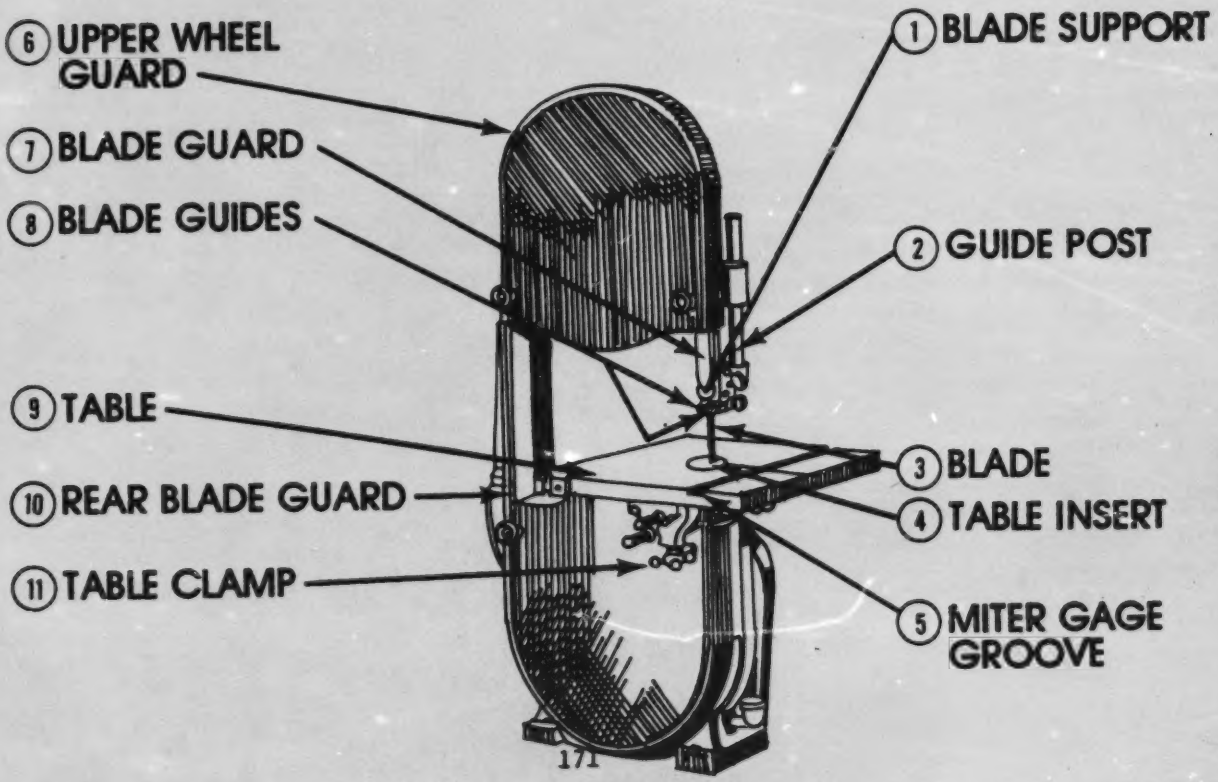


OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Band Saw

SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Remove jewelry, eliminate loose clothing and confine long hair.
3. Use properly secured and adjusted guards at all times.
4. Adjust the guide and guard to within 1/4 inch of work.
5. Remove scrap only when machine is stopped.
6. Avoid backing out of a cut (kerf).
7. Keep hands and fingers in such a position that there is no danger of their slipping into the blade. Hold work piece on either side of the cutting line. Use a push stick where necessary.
8. Do not leave the machine until it has stopped.
9. Consult with your instructor before cutting large or irregular shaped pieces.



BAND SAW

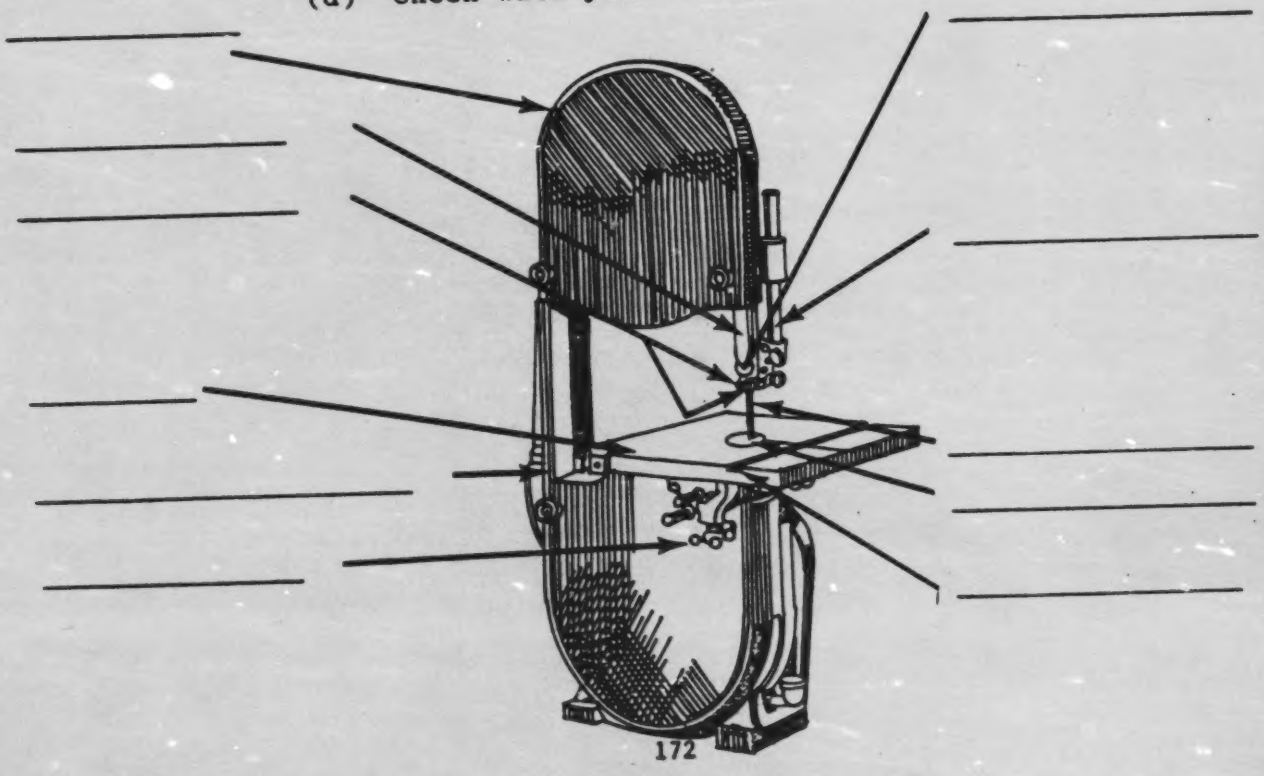
Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	It is safe to tilt the table for cutting bevels.	T	F
2.	The lower band wheel does not require a guard.	T	F
3.	The saw should be stopped by forcing a piece of wood against the blade.	T	F
4.	The blade guard should be adjusted to about 1/4" from the work.	T	F
5.	It is safe to use the fence for cutting several pieces of wood to the same length.	T	F
6.	The hands should come no closer than 2" from the blade.	T	F
7.	The blade guides should be adjusted tight against the blade.	T	F
8.	Instructor's permission is required to operate a band saw.	T	F
9.	Adjustments should be made with the power off.	T	F
10.	Eye protection is not required when operating a band saw.	T	F

11. If the work does not cut easily you should:

(a) speed up the blade
(b) push harder
(c) replace the blade
(d) check with your instructor



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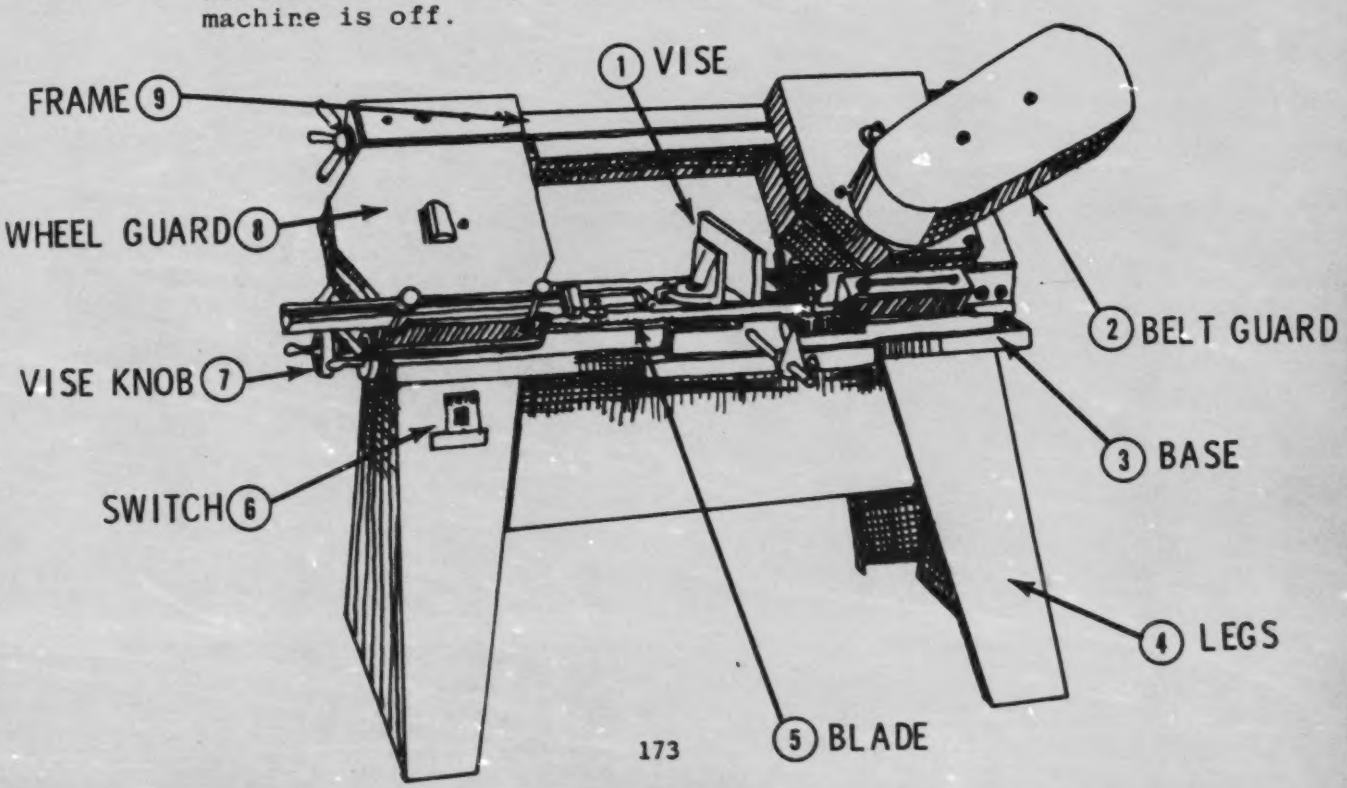
Horizontal Band Saw

SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Be sure all guards are in place and operating correctly.
3. All adjustments to the chip removal brushes, guides, vise, and drive system should be done with the power off.
4. Be sure the blade guides are properly adjusted before starting the cut.
5. Be sure the material being sawed is properly positioned and tightly clamped before starting the cut.
6. Do not allow the blade to drop on the material to be cut.
7. Keep your hands away from the cutting area and brush away chips only when the machine is off.



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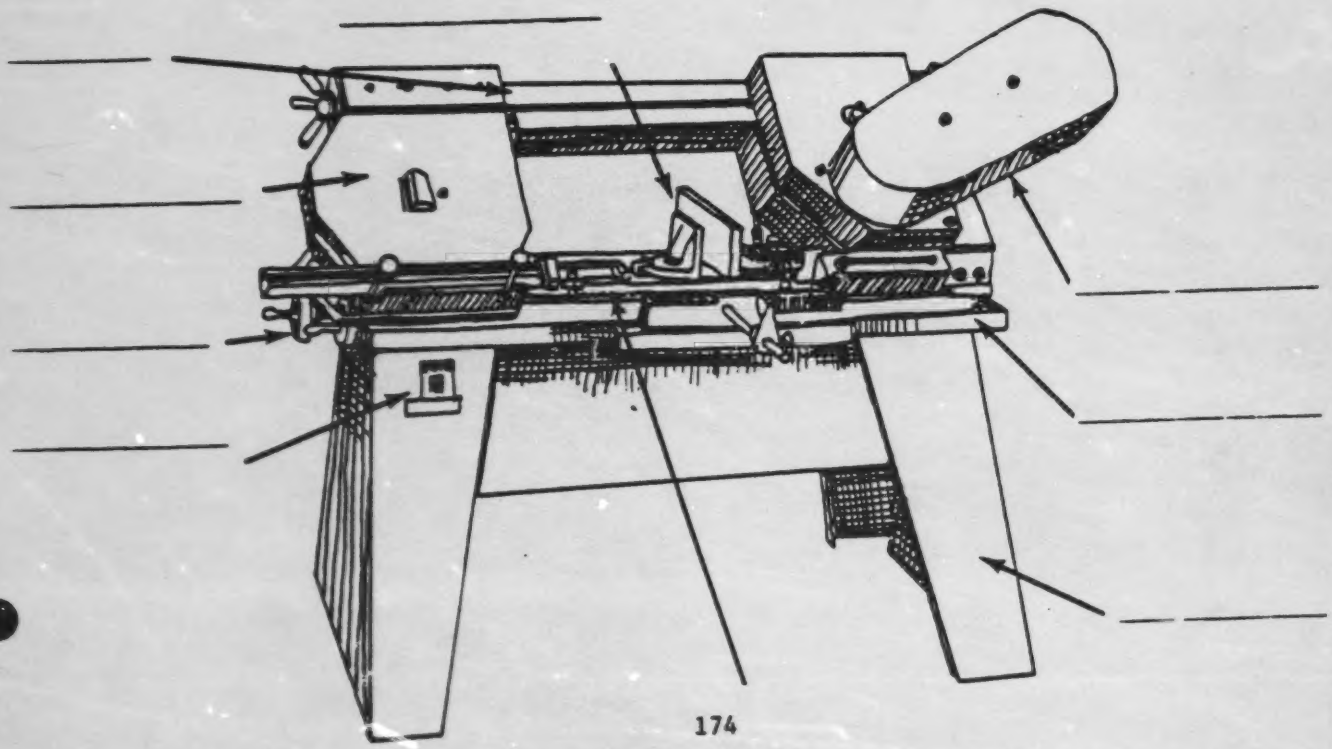
HORIZONTAL BAND SAW

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	The position of the blade guides is not a safety factor.	T	F
2.	Metal chips should be removed when the machine is in operation.	T	F
3.	The material being sawed must be properly positioned and tightly clamped.	T	F
4.	The operator must wear eye protection when using the horizontal band saw.	T	F
5.	The blade should not be allowed to drop onto the material being cut.	T	F
6.	All machine adjustments should be made with the power off.	T	F



SANDER

Safety Instructions

1. Obtain permission from your teacher before using sanding machine.
2. Hold work securely.
3. Make adjustments only when sander is at a dead stop. Portable sander electric cord should be disconnected.
4. Check belt or disc for breaks or tears.
5. Be sure that the switch is in off position and machine is on its side before plugging in electric cord on a portable sander.
6. Wear face shield or safety glasses (goggles, spectacles).
7. Turn on power after permission is given.
8. Keep fingers away from the abrasive surface on the sander.
9. Sand on downward motion side of disc sander.
10. Use special care in sanding small or irregular pieces. Check with your teacher.
11. Feed stock into the abrasive material at a moderate rate of speed and pressure.
12. Turn off power and rest portable sander on its side while changing position of board.
13. Turn off power after using sander and stand by until the machine has stopped.
14. Disconnect electric cord of portable sander and return cleaned machine to designated place.

Safety Test Questions

I

( ) 1. You should make all adjustments on the portable sander: (a) while the electric cord is disconnected; (b) only when other students are at a safe distance; (c) with one hand; or (d) while it is in gear.

( ) 2. Before you plug in the electric cord of the portable sander, you should be certain: (a) machine is free of sawdust; (b) machine is resting on its abrasive surface; (c) sanding belt or disc has been removed; or (d) switch is turned off and machine is on its side.

( ) 3. When operating a disc sander, you should hold your work against the disc: (a) rim; (b) center; (c) upward motion side; or (d) downward motion side.

( ) 4. While sander is in motion, you should: (a) blow away the sawdust; (b) remove abrasive surface; (c) use extreme feed pressure; or (d) keep your finger away from abrasive surface.

( ) 5. You should feed stock into the abrasive material of the sander: (a) as fast as possible; (b) at a moderate rate of speed and pressure; (c) both upward and downward; or (d) both forward and backward.

II

_____ 1. You should make adjustments on the portable sander while the electric cord is _____.

_____ 2. When operating a disc sander, you should hold your work on the side where the motion is _____.

_____ 3. While sander is in motion, you should keep your fingers away from the abrasive_____.

_____ 4. You should feed stock into the sanding machine at a moderate rate of speed and _____.

_____ 5. Before plugging in the portable sander, you should make sure the switch is _____.

Answers to Test Questions

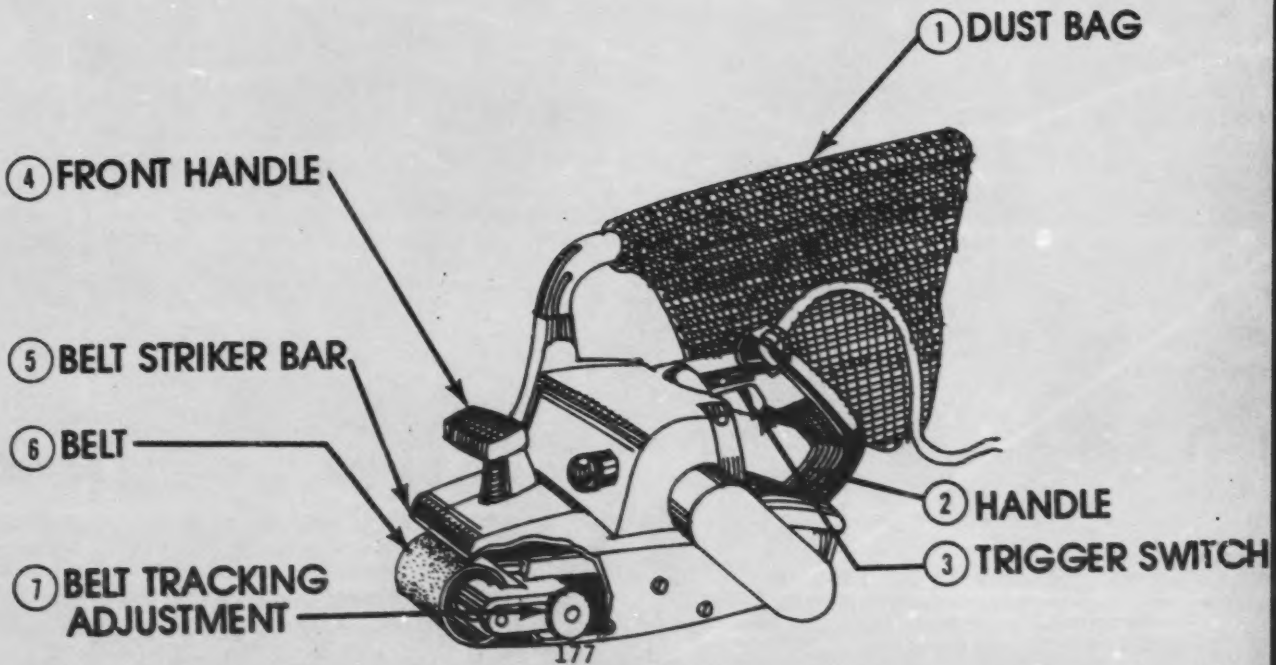
I. 1.(a); 2. (d); 3. (d); 4. (d); 5. (b)
II. 1. disconnected; 2. downward (down); 3. surface (face); 4. pressure; 5. off

OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Belt Sander

SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Check to see if belt is properly installed and in good condition before starting.
3. Start sander above work; let rear of belt touch first.
4. Keep the electrical cord clear and the dust bag away from the sander belt.
5. Lift sander off the work before stopping.
6. Wait until belt is completely stopped before placing sander on bench.
7. Empty dust bag daily into proper waste container.



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BELT SANDER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

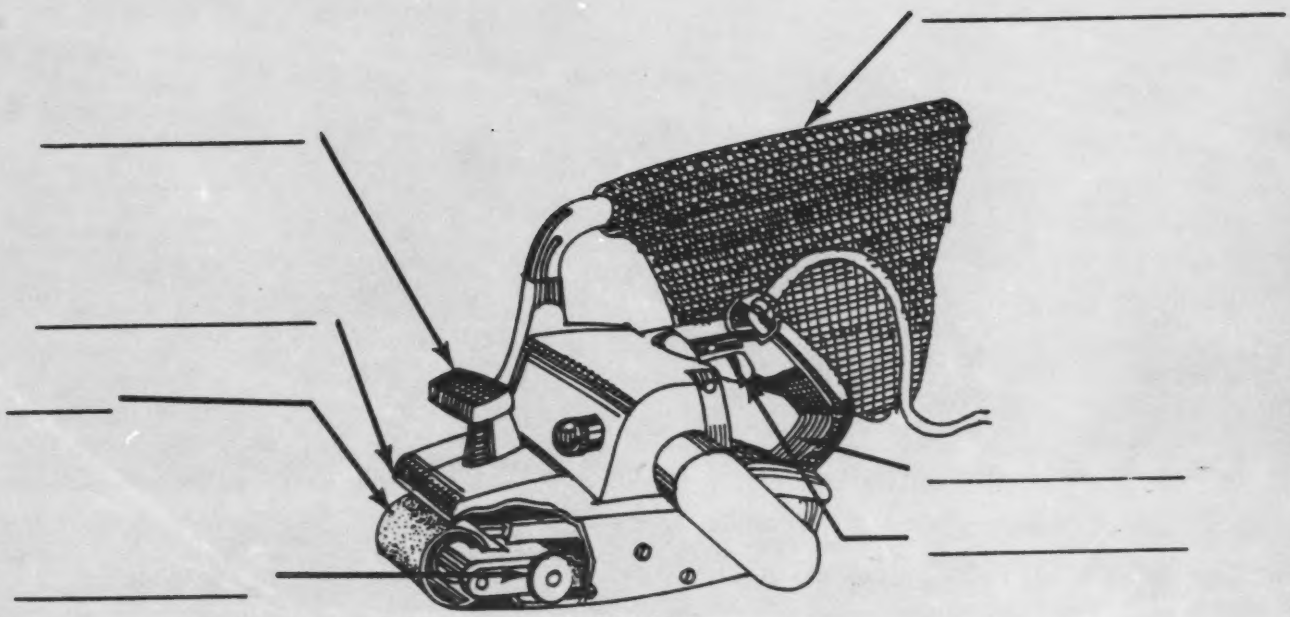
1. Eye protection is required when using this machine. T F

2. You should have a firm grasp on the sander before starting. T F

3. The sander should rest on the work when starting: T F

4. A wood sander should not be used on steel. T F

5. This machine should be examined before starting. T F



OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Buffer

SAFETY SUGGESTIONS

1. Always buff using the lower half of the wheel (below center).
2. Always wear eye protection when buffing.
3. Always stand to one side of the wheel when buffing and when applying compound.
4. Never use a rag to hold the work while you are buffing.
5. Use extra caution when buffing around corners, openings or areas where the wheel could grab and throw the work. Do not buff small diameter tubing, wires, chain or similar material.
6. Exercise caution so that the work does not overheat and burn your hands.
7. Be sure the area behind the buffer is open and that no one else is in the safety zone.
8. If your hairstyle presents a potential hazard, you must fasten it securely or wear a protective hair cover.
9. Remove or fasten any loose clothing, neckties or jewelry. Roll loose sleeves to the elbow.

BUFFER

Student Name_____
Class_____
Date_____ Grade_____

SAFETY QUIZ

1. A rag should be used to hold hot objects while buffing. T F

2. Always buff on the lower half of the wheel. T F

3. Loose clothing or hair must be confined. T F

4. Goggles must be worn when buffing. T F

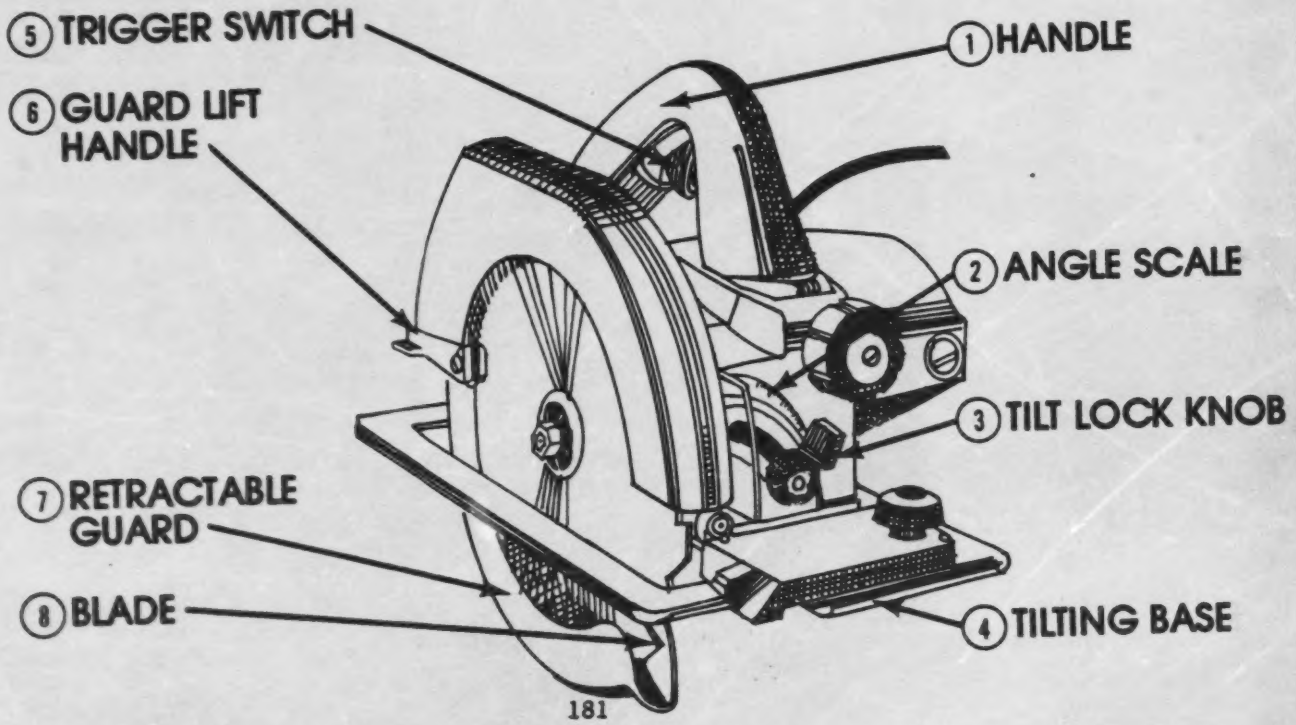
5. Use extra caution when buffing corners or confined areas of the work. T F

OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Portable Circular Saw

SAFETY SUGGESTIONS

1. Make sure that telescoping guard returns automatically to cover the blade after each cut.
2. Do not set saw down until blade stops.
3. Approved eye protection must be worn while using saw.
4. If the saw blade binds or smokes, stop cutting immediately.
5. Make sure the power cord is clear of the blade.
6. Be sure the material you are cutting is adequately supported.
7. Remove tie, rings and watch, and roll up sleeves.
8. Check the base setting for the proper depth of cut.



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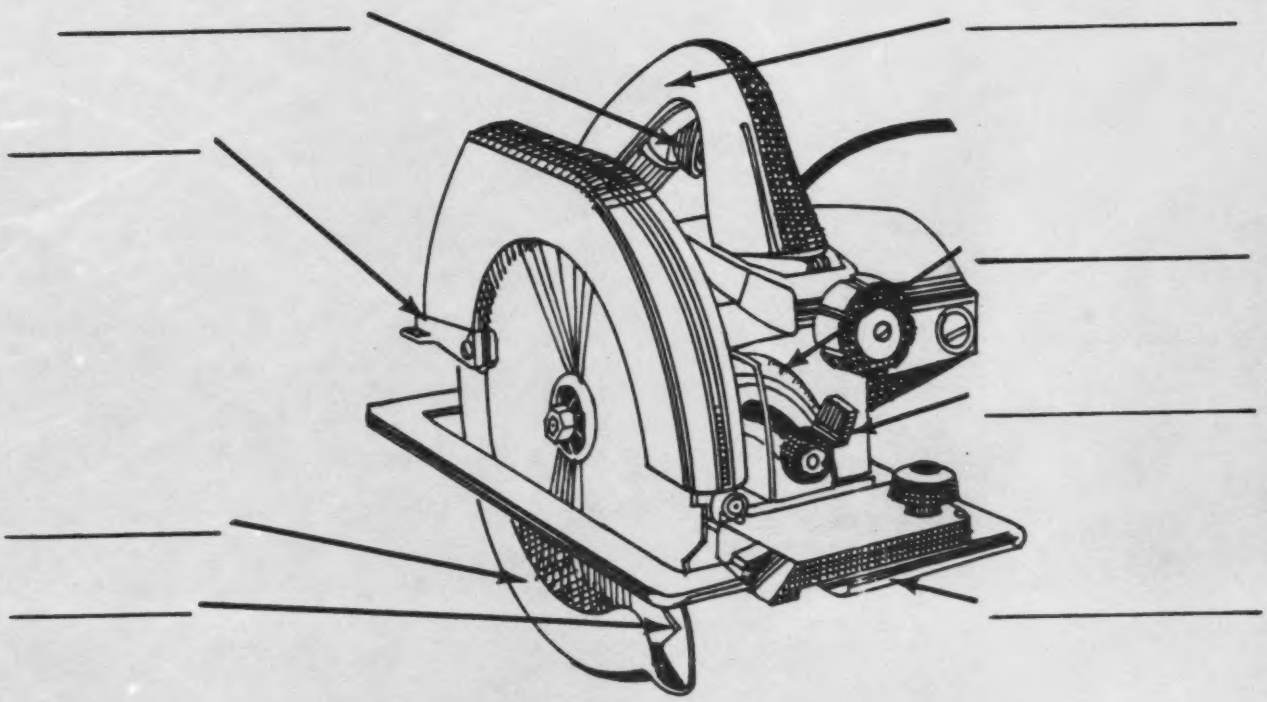
PORTABLE CIRCULAR SAW

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	Permission should be obtained before operating this machine.	T	F
2.	The guard can be wedged so that it will not be operable.	T	F
3.	Eye protection is not necessary when using this machine.	T	F
4.	You should not set the saw down until it has completely stopped.	T	F
5.	The saw blade should extend about 1/8" beyond the thickness of the material being cut.	T	F



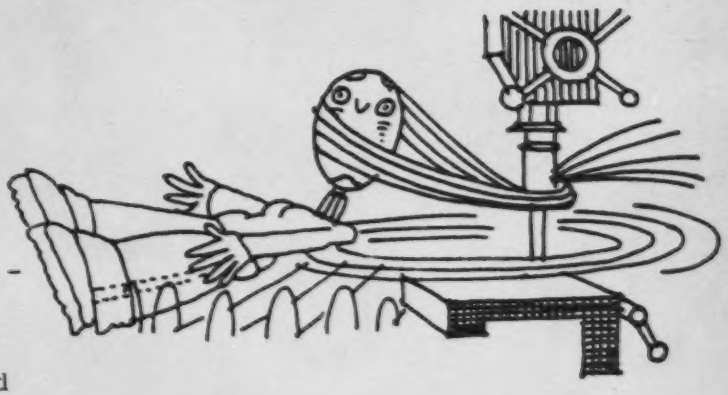
DRILL PRESS

Safety Instructions

1. Obtain permission from your teacher before using the drill press.
2. Shift belt and make other adjustments only when power switch is turned off.
3. See that belt guard is in place.
4. Be certain that the table and head of drill press are secure.
5. Select proper drill (be sure it is sharp) and coolant.
6. Remove chuck key immediately after using it.
7. Use drill press vise whenever possible. Clamp vise or work to drill press table.
8. Make sure that no one but you is inside the operator's zone.
9. Wear face shield or safety glasses (goggles, spectacles).
10. Turn on power after permission is given.
11. Keep hands away from revolving spindle, chuck, drill, and chips.
12. Operate feed handle so that drill cuts evenly into work.
13. Ease up on feed pressure when drill begins to break through material.
14. Back drill out as soon as hole is drilled.
15. Stop the drill press before attempting to remove work, chips, or cuttings.
16. Use a brush to remove chips or shavings.
17. Keep floor clean around drill press.
18. Step away immediately if work comes loose and is seized by drill; shut off power if possible without endangering self.
19. Turn off power after using drill press and stand by until the machine has stopped.
20. Clean off drill press table and surrounding area. Return cleaned drills, coolants, and clamping devices to designated place.

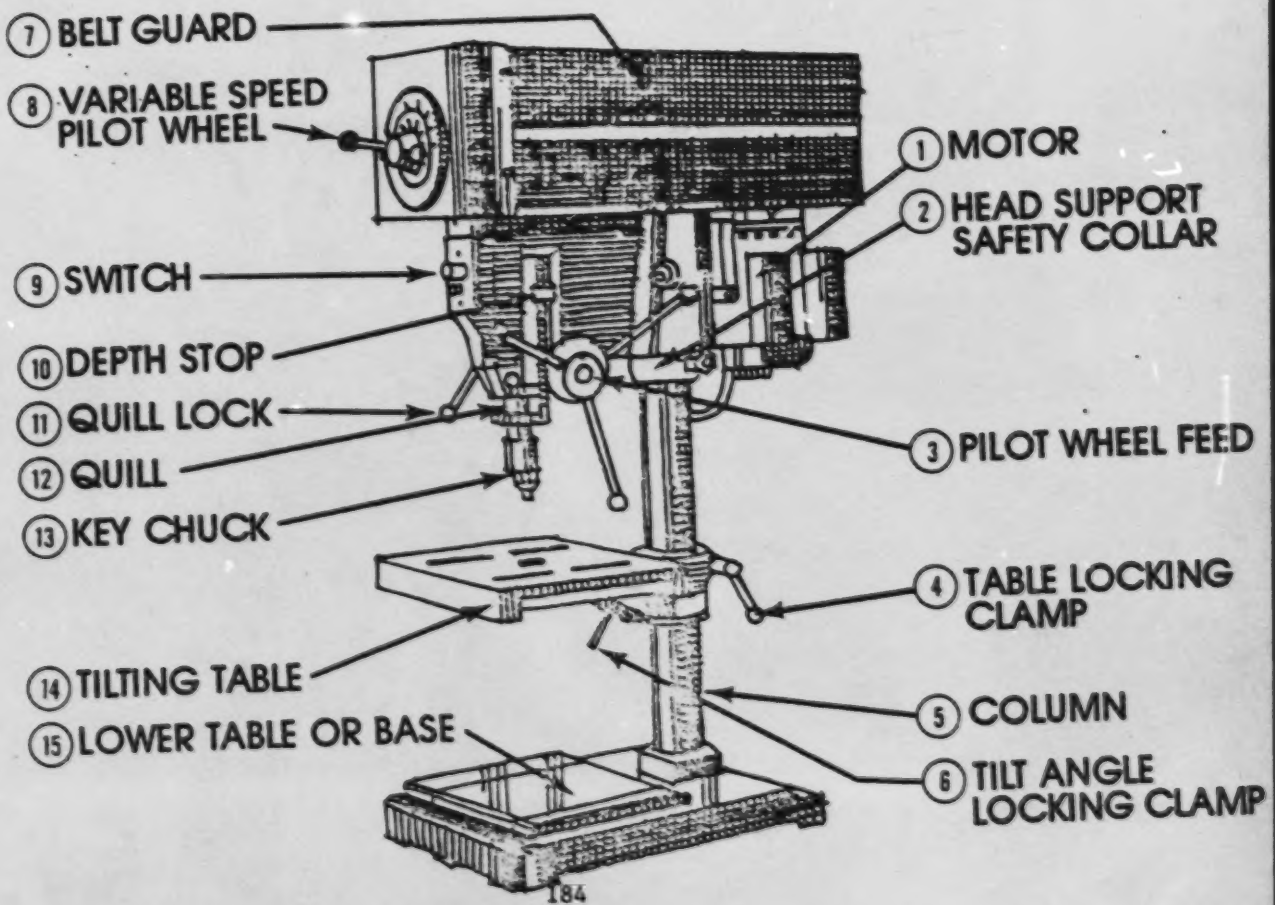
OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Drill Press



SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Remove jewelry - eliminate loose clothing - confine long hair.
3. Operate only when all guards are in place.
4. Select properly sharpened drill bit - tighten in chuck and remove key.
5. Clamp material - check for safety - turn on power.
6. If a piece of work is caught in the drill -- turn off power -- do not try to stop by hand.
7. Select speed carefully -- the larger the drill the slower the speed.



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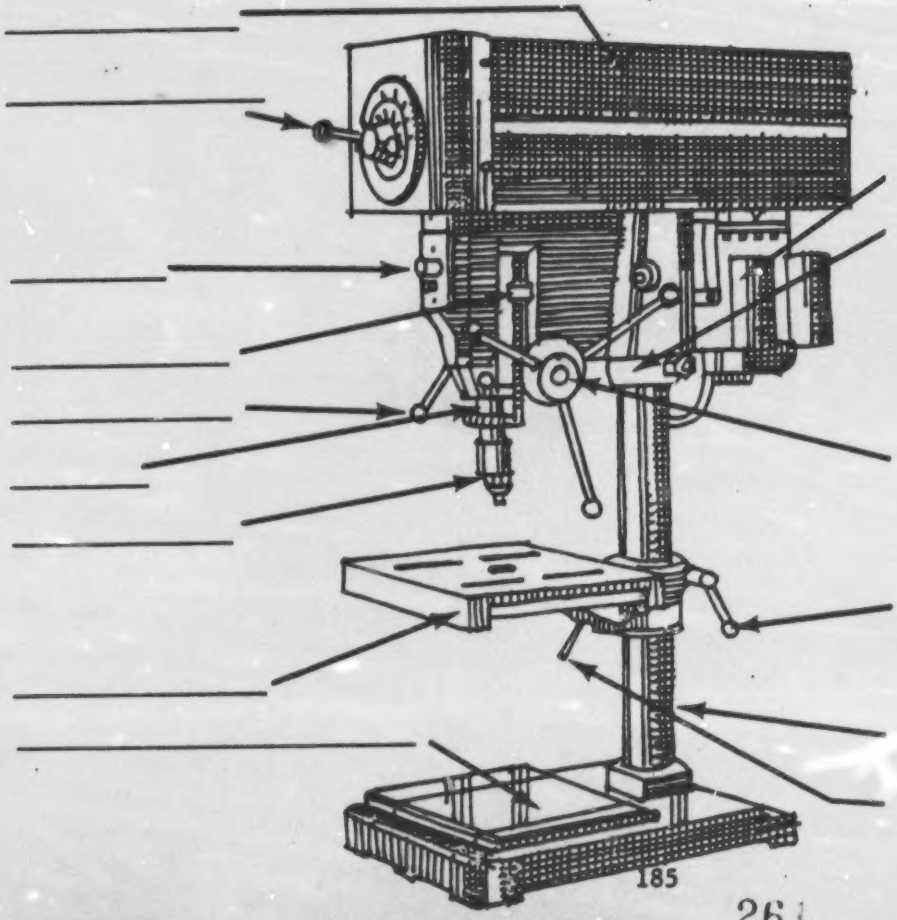
DRILL PRESS

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	It is necessary to select the proper speed.	T	F
2.	The chuck key should be kept in the chuck at all times.	T	F
3.	Work should always be secured.	T	F
4.	Rings may be worn while operating a drill press.	T	F
5.	A chip brush should be used for removing chips.	T	F
6.	The drill should be operated at top speed for all work.	T	F
7.	The long end of the work should be at the left of the operator.	T	F
8.	Long hair must be fastened securely or protective hair cover used.	T	F



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PORTABLE ELECTRIC DRILL

Safety Instructions

1. Obtain permission from your teacher before using portable electric drill.
2. Select proper drill (be sure it is sharp) and coolant.
3. Make sure switch is in an "off" position.
4. Remove chuck key immediately after using it.
5. See that a grounded wire is connected to the portable electric drill.
6. Keep drill, electric cord, and plug dry at all times.
7. Plug in electric cord.
8. Hold the machine firmly.
9. Turn on power after permission is given.
10. Keep hands away from revolving spindle and drill.
11. Apply straight and steady pressure on the drill.
12. Ease up on pressure just before drill begins to break through material.
13. Back drill out as soon as hole is drilled.
14. Turn off power and hold machine firmly until it comes to a dead stop- then rest machine on its side.
15. Disconnect electric cord. Clean and return machine to designated place.

Safety Test Questions

I

( ) 1. You should select a location that is dry and not grounded for using a protable electric tool or appliance so as to avoid: (a) soiling the equipment; (b) serious electric shock; (c) motor bearings deterioration; or (d) discoloring the electric cord.

( ) 2. By removing the chuck key from the drill chuck before turning on the power, you will prevent the: (a) chuck form being damaged; (b) drill from breaking; (c) chuck key from being thrown out at a terrific speed; or (d) chuck from becoming unbalanced.

( ) 3. Before plugging in the portable electric drill, you should: (a) remove the drill; (b) check the armature; (c) make sure the switch is off; or (d) disconnect the ground wire.

( ) 4. When you turn off the switch on the portable electric drill, you should: (a) disconnect electric cord; (b) inspect rotor; (c) blow the sawdust out of the armature opening; or (d) hold the machine firmly until it comes to a dead stop.

II

_____ 1. You should select a location that is dry and not grounded for using a portable electric tool or appliance so as to avoid serious electric _____.

_____ 2. Be sure to remove the chuck key from the drill chuck before you turn the power_____.

_____ 3. Before plugging in the electric drill, you should make certain the switch is _____.

_____ 4. When you turn off the switch on the portable electric drill, you should hold the machine firmly until it comes to a _____.

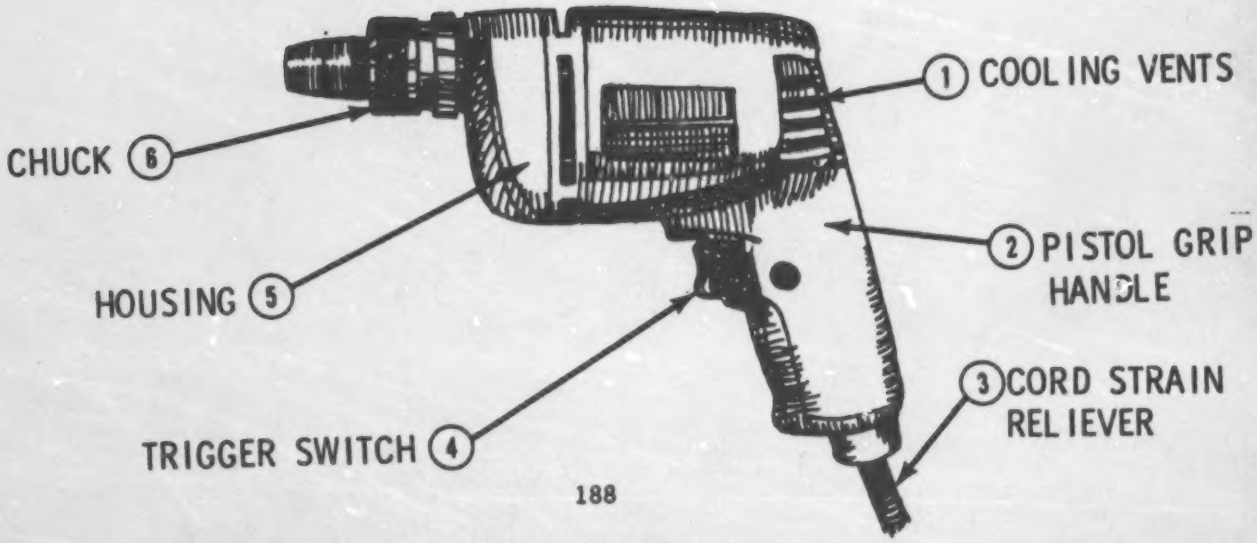
Answers to Test Questions

I. 1. (b); 2. (c); 3. (c); 4. (d)
II. 1. shock; 2. on; 3.off; 4. stop

Portable Electric Drill

SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Disconnect the electric cord plug from the power outlet when changing drill bits.
3. Be sure the switch is off and the chuck key is removed before you connect the cord plug to the power source.
4. Do not use in damp or wet area.
5. Be sure the material being drilled is tightly clamped or secured.
6. Drill with a straight steady even pressure.
7. Be sure the drill bit is used and properly secured in the chuck.

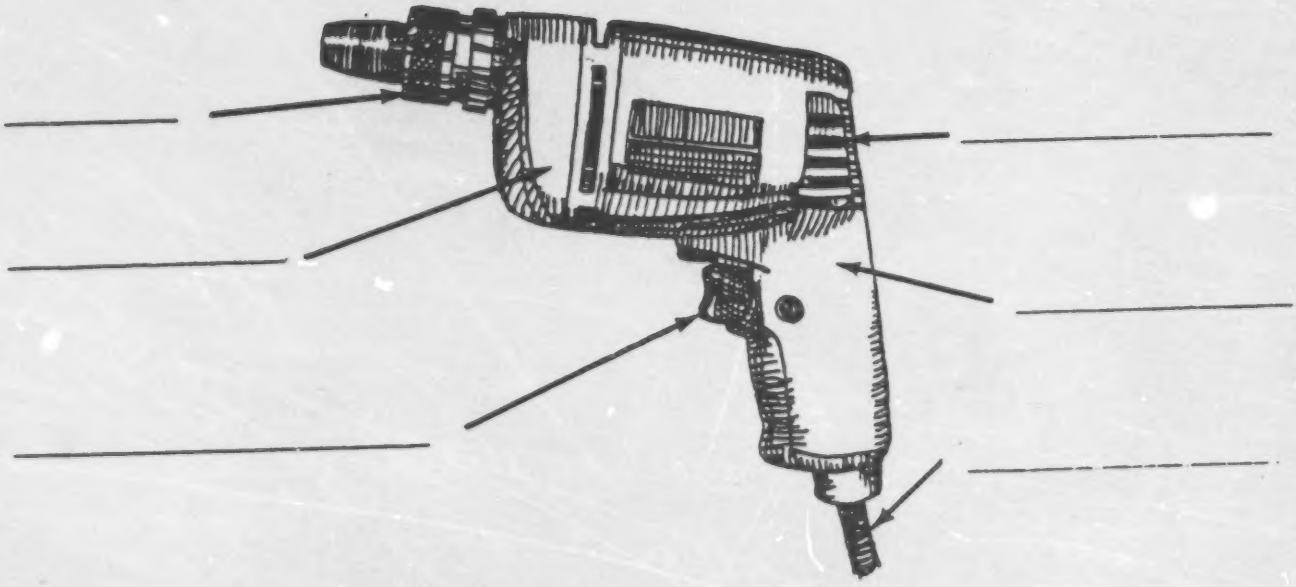


PORTABLE ELECTRIC DRILL

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

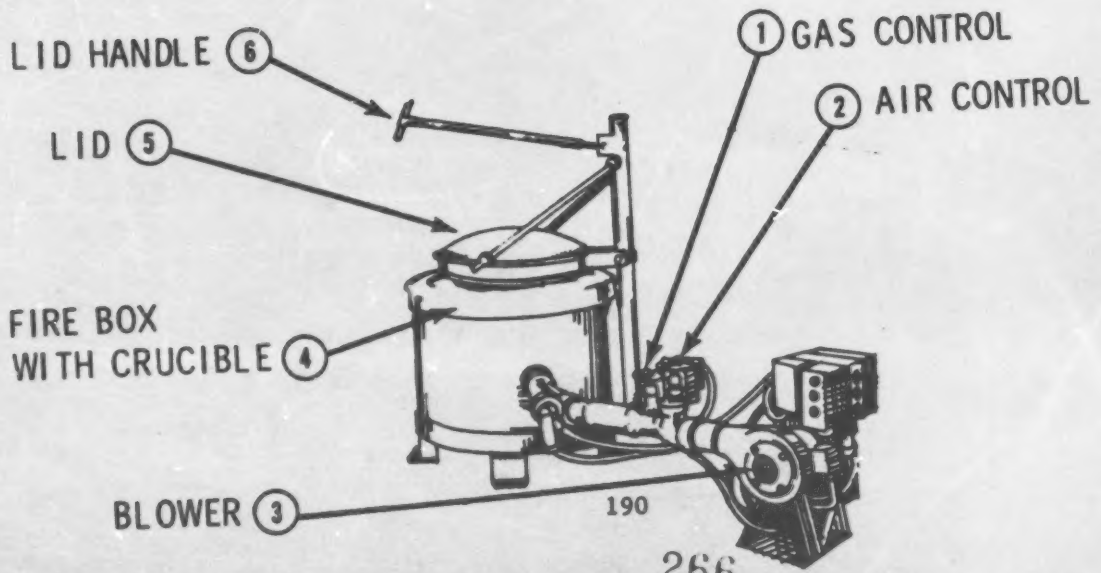
1.	Eye protection is not needed when drilling wood.	T	F
2.	Electric powered portable tools should not be used in wet areas.	T	F
3.	The electrical cord plug of the drill should be disconnected from the power source when changing drill bits.	T	F
4.	Holes should be drilled with short jerky movements.	T	F
5.	The drill bit must be secure in the drill chuck.	T	F
6.	The chuck key should remain in the chuck when drilling.	T	F



Furnace, Foundry

SAFETY SUGGESTIONS

1. Approved eye and face protection must be worn when working around molten metal.
2. Approved clothing must be worn: gloves, sleeves, apron and leggings.
3. The instructor must be present when molten metal is poured.
4. Do not pour molten metal on a concrete floor.
5. Do not drop ingots or other objects into molten metal.
6. Never pour molten metal into objects containing water or other liquids.
7. Only authorized students should be allowed in the area when metal is being poured.

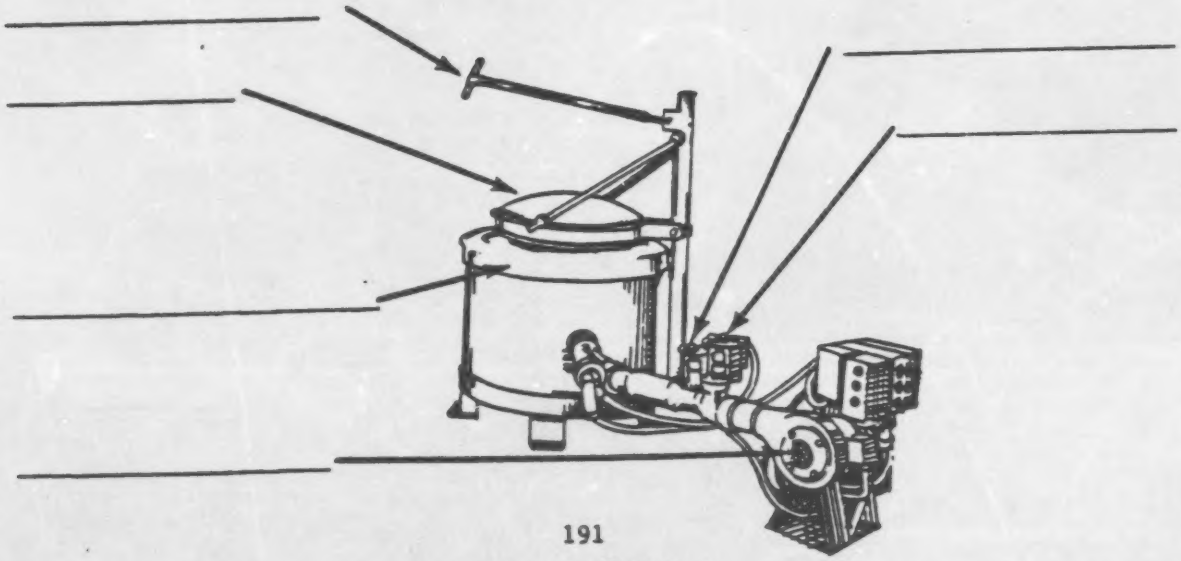


FURNACE, FOUNDRY

Student Name_____
Class_____
Date_____Grade_____

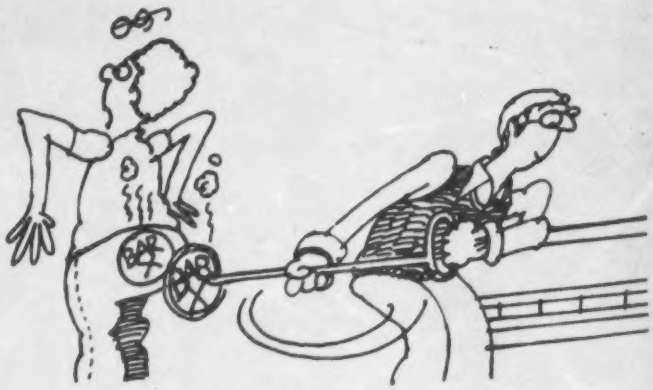
SAFETY QUIZ

1.	Eye and face protection must be worn when working around molten metal.	T	F
2.	Molten metal may safely be poured onto a concrete floor.	T	F
3.	Water and other liquids are no particular problem when pouring molten metals.	T	F
4.	Ingots should not be dropped into molten metals.	T	F
5.	Protective clothing should be worn around molten metals.	T	F



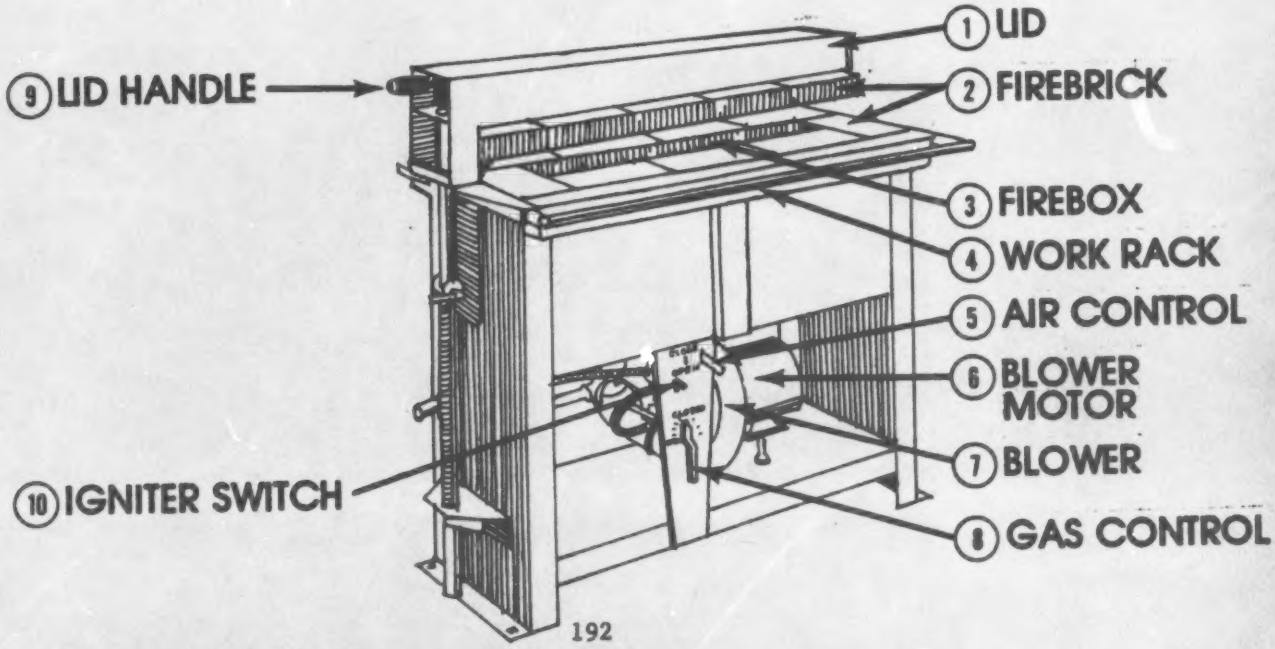
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Gas Forge



SAFETY SUGGESTIONS

1. Approved eye protection must be worn when operating forge.
2. Asbestos mittens (gloves) must be worn when the tongs cannot be used.
3. A pail of water should be nearby at all times.
4. Hot metal left unattended should be marked "HOT" with chalk.
5. The top must be open when lighting the forge.
6. When shutting down, the gas control should be turned off first.
7. Be sure gas is off "tight" when leaving the forge.



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GAS FORGE

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

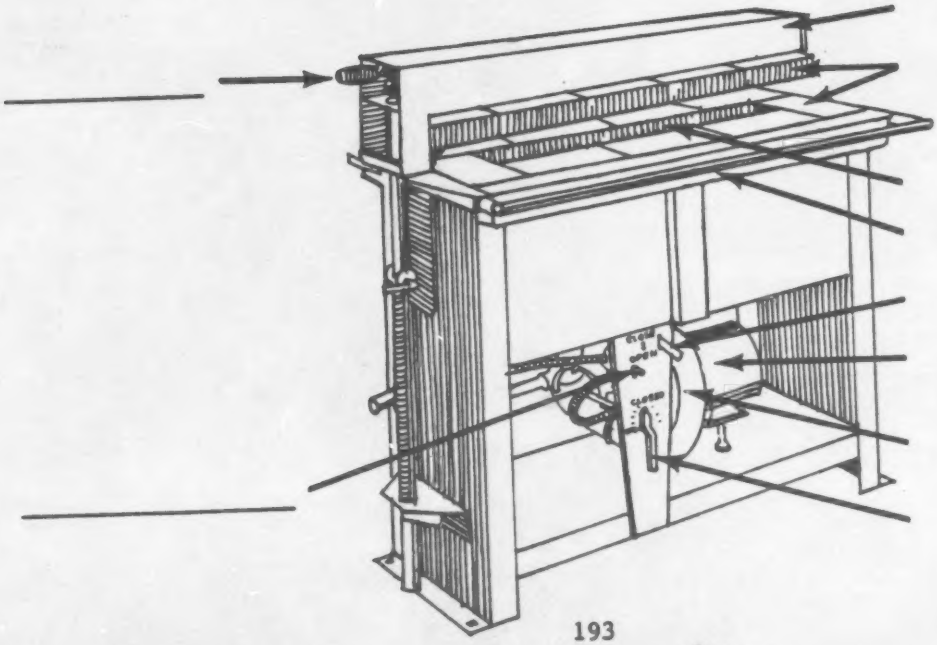
1. Tongs should be available for the handling of hot metal. T F

2. Gloves should be worn when handling the tongs. T F

3. The top slot should be closed when lighting the forge. T F

4. The air should be turned off first when shutting down. T F

5. Hot metal left lying around should be marked "HOT". T F



GRINDER

Safety Instructions

1. Obtain permission from your teacher before using grinder.
2. Set tool rest 1/16 in. to 1/8 in. from the wheel.
3. Dress wheel when necessary.
4. See that guard is in place.
5. Make sure that no one but you is inside the operator's zone.
6. Wear face shield or safety glasses (goggles, spectacles) and use glass safety guard on grinder.
7. Stand to one side of wheel.
8. Turn on power after permission is given.
9. Keep hands away from the wheel while it is in motion.
10. Hold work with your hands. Ask your teacher for special instruction and permission to grind small pieces.
11. Use the face of the wheel only.
12. Press material against the wheel with correct amount of pressure.

Safety Test Questions

I

( ) 1. You must wear a face shield or safety glasses (goggles, spectacles) when using grinder because these: (a) are becoming to you; (b) magnify the work, thus making it easier for you to see; (c) protect your eyes from bright light; or (d) protect your eyes from flying particles.

( ) 2. The grinder tool rest must be securely fastened: (a) immediately after grinder is turned on; (b) one inch away from wheel; (c) when wheel is not in motion; (d) after power is turned off and the wheel is coasting.

( ) 3. You should set grinder tool rest: (a) 1/4 inch away from wheel; (b) so wheel rubs lightly against tool rest; (c) 1/2 inch away from wheel; or (d) no more than 1/8 inch from wheel.

( ) 4. To grind small pieces of stock, you should: (a) hold them in your bare hands; (b) hold them with a rag; (c) use a very coarse wheel; or (d) receive special instruction and permission from your teacher.

( ) 5. You should stand to one side of grinding wheel while it is gathering speed because: (a) if it has a defect, the wheel may fly to pieces; (b) the air currents from wheel are unhealthful; (c) it will tempt you to use the wheel too soon and cause it to stop; or (d) you can see if the wheel is running true.

II

_____ 1. You must wear a face shield or safety glasses (goggles, spectacles) when using the grinder because these will protect your_____.

_____ 2. The grinder tool rest should be set away from grinding wheel no more than _____ inch.

_____ 3. When using the grinder, you should keep your hands away from the _____.

_____ 4. To grind small pieces of stock, you should obtain special permission from the _____.

_____ 5. When starting the grinder, you should stand to one _____.

Answers to Test Questions

I. 1. (d); 2. (c); 3. (d); 4. (d); 5. (a)

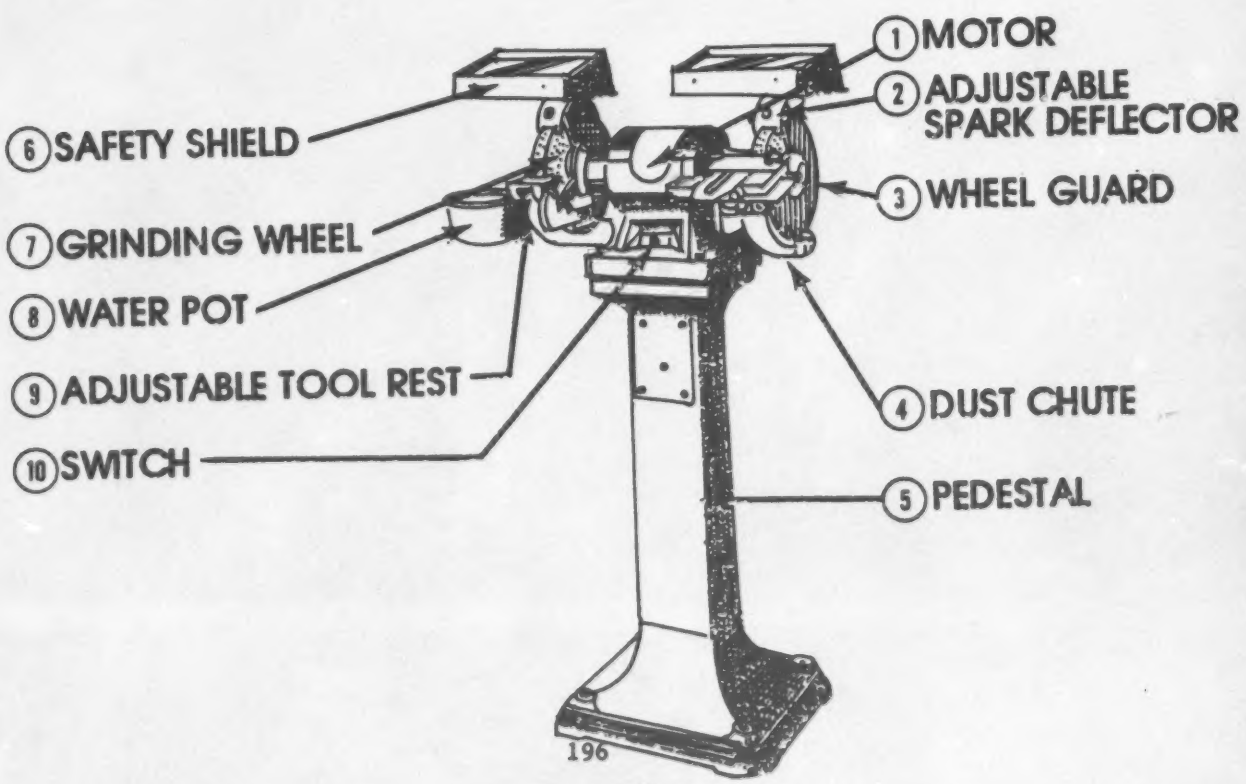
II. 1. eyes; 2. 1/8; 3. wheel; 4. teacher; 5. side

OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Grinder

SAFETY SUGGESTIONS

1. Approved eye protection must be worn at all times.
2. All guards must be properly adjusted.
3. The tool rest must be adjusted to 1/8" from the wheel.
4. Do not grind on the side of the grinding wheel.
5. Spark deflector or top guard must be within 1/8" of wheel.
6. Small pieces should be held with "vise grip" type pliers.
7. A wheel that is excessively worn or cracked should be discarded.
8. The glass safety shield should be clean.
9. Stand to one side when starting the machine.

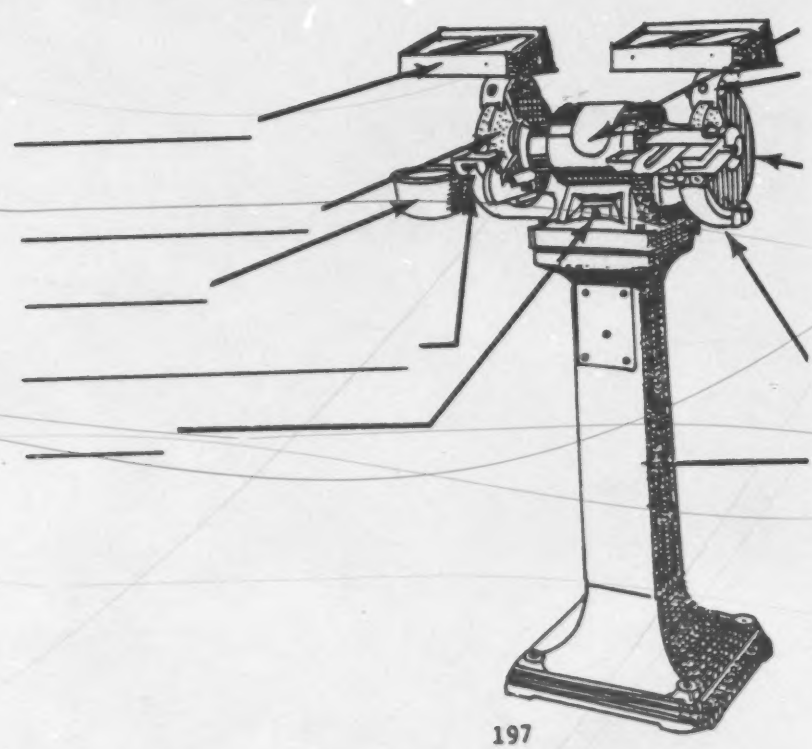


GRINDER

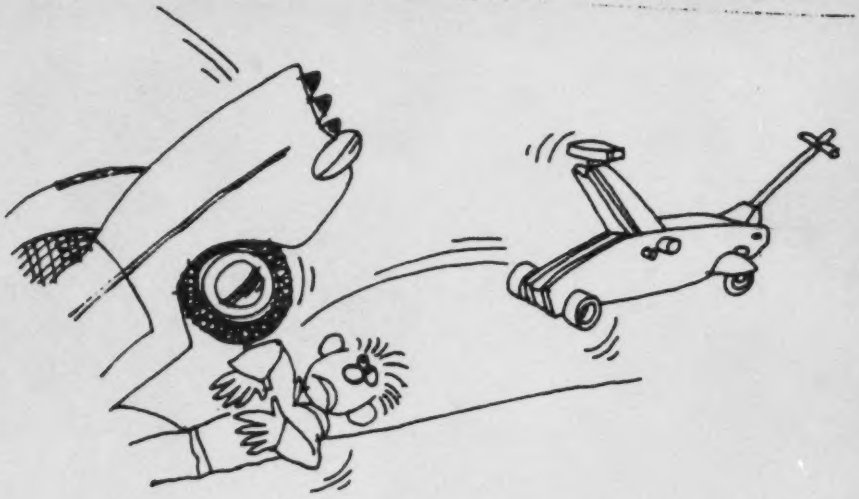
Student Name_____
Class_____
Date_____ Grade_____

SAFETY QUIZ

1. The tool rest should be adjusted to within 1/2" of wheel. T F
2. Eye protection is not always necessary while grinding. T F
3. Once the "off" switch is in the off position, the operator may leave. T F
4. The safety shield should be clean. T F
5. Wheels that are out of balance may be used. T F
6. The spark arrestor is not necessary if there is a glass safety shield. T F
7. When grinding a small piece of steel, "vise grips" are advised. T F
8. If there is a glass shield, eye protection is not required. T F

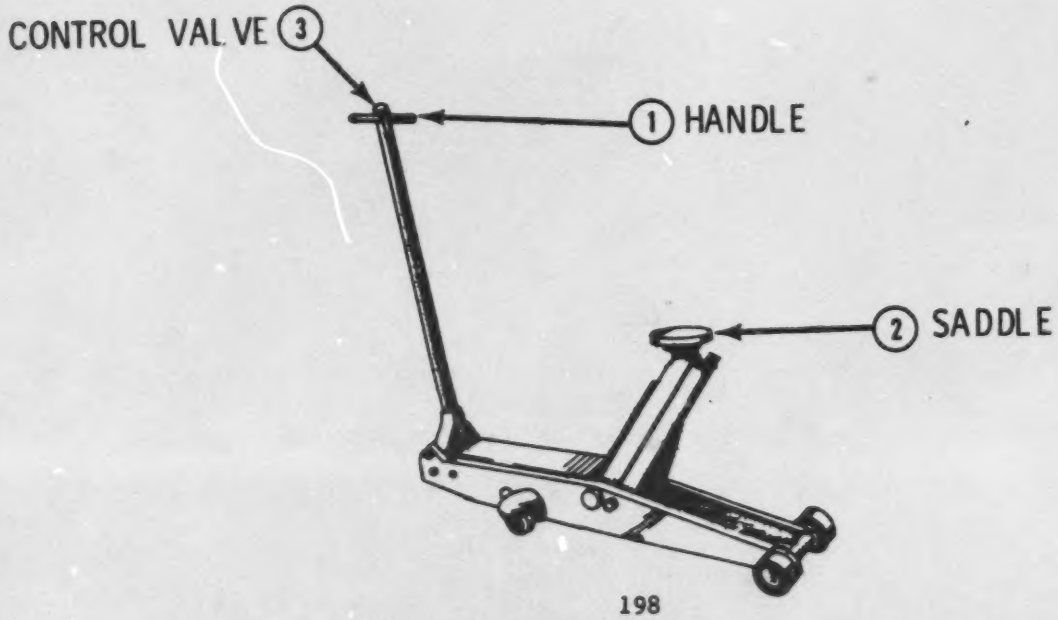


Service Jack



SAFETY SUGGESTIONS

1. When using the jack, be sure it is securely placed and lift saddle properly aligned to prevent slipping.
2. Once saddles are located, apply some pressure, then stop and examine these before lifting the car.
3. Never raise a car while someone is under it.
4. Always use car stands or supports before going under a raised car.
5. Inspect the jack for oil leaks or other malfunctions before using.
6. Never work under a vehicle supported only by a service jack.



SERVICE JACK

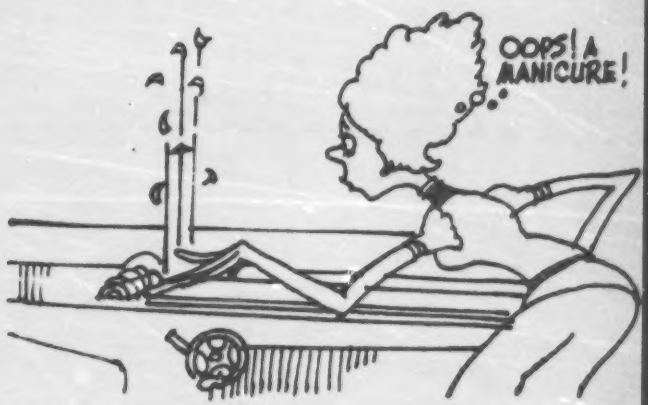
Student Name_____
Class_____
Date_____Grade___

SAFETY QUIZ

1.	It is unsafe to work under a car that is supported with a service jack only.	T	F
2.	It is good safety practice to raise a car with someone under it.	T	F
3.	It is necessary to inspect the lift saddles for proper alignment when raising a car.	T	F
4.	The service jack should always be inspected for malfunctions before using.	T	F
5.	Car stands on supports should be used before anyone goes under a raised car.	T	F

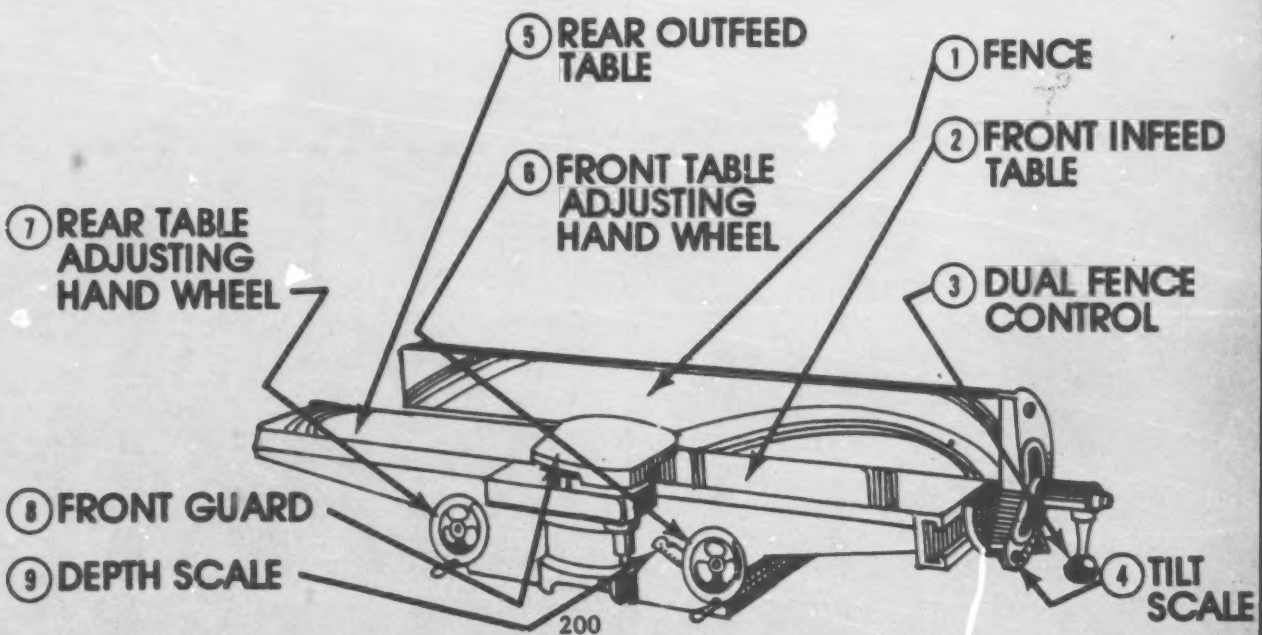
OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Jointer



SAFETY SUGGESTIONS

1. Before starting, make sure that guards are free and will cover the blade at all times.
2. A push stick must be used on all material that would bring the hands within 2" of the cutter.
3. An assistant should help support long pieces.
4. Several light cuts are safer than one heavy cut.
5. Wear approved eye protection.
6. The board being jointed must exceed the minimum length established for that particular machine (check with instructor).

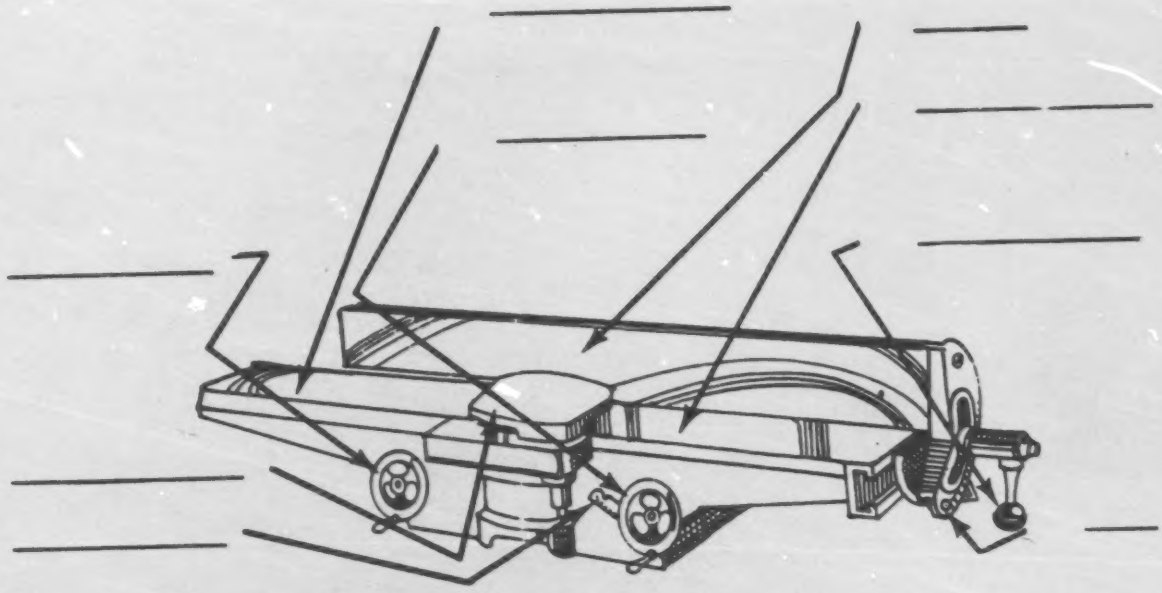


JOINTER

Student Name_____
Class_____
Date_____ Grade_____

SAFETY QUIZ

1. It is possible for the guard to stick and not cover the cutter. T F
2. A push stick should be used when the hands could get close to the cutter. T F
3. Eye protection is not necessary when operating a jointer. T F
4. Permission should be obtained before using the jointer. T F
5. Stock shorter than 6" may be processed on the join er. T F

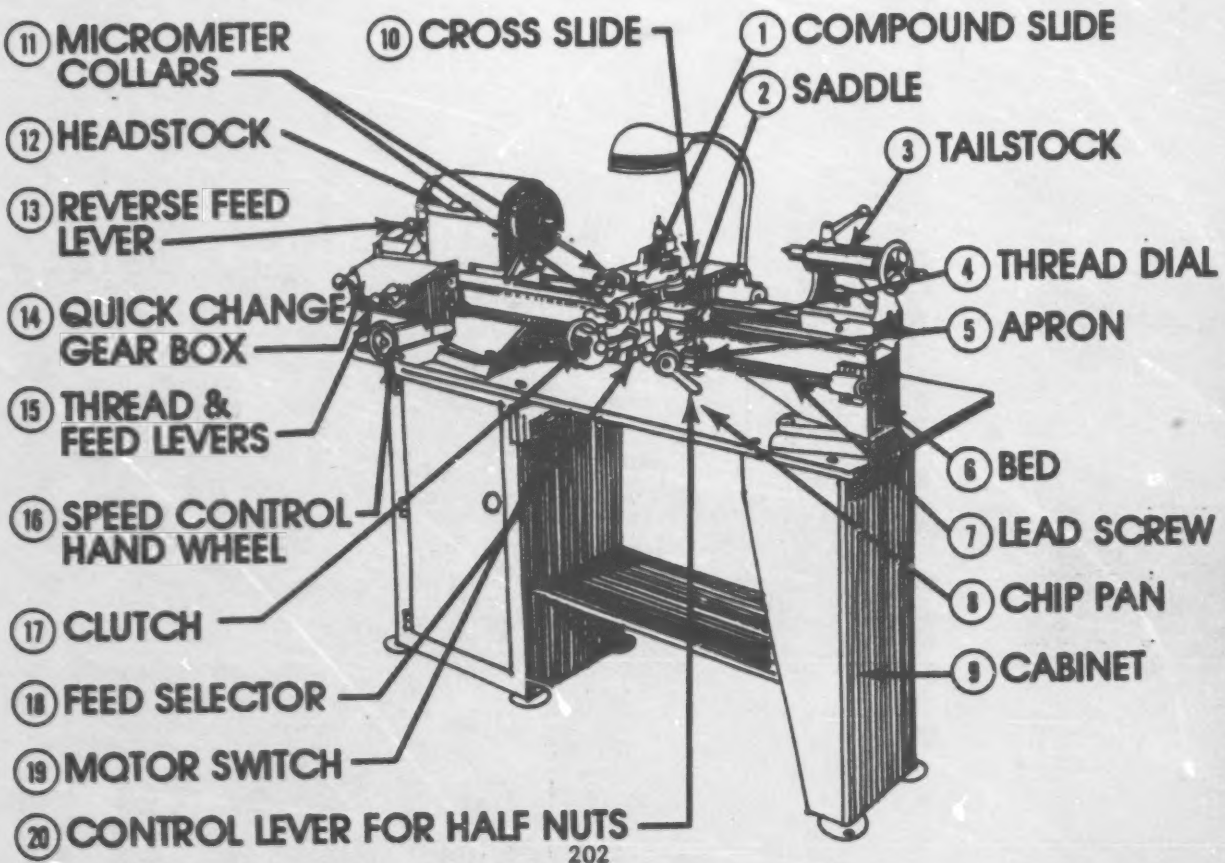


OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Metal Lathe

SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Remove jewelry, eliminate loose clothing and confine long hair.
3. Do not leave the machine until it has stopped.
4. A brush should be used to remove chips.
5. The chuck should be turned by hand before starting.
6. Never leave chuck wrench in chuck.
7. Stock should be balanced and secured before starting.
8. Operate at the correct speed for the job.
9. Handle chucks with care; keep hands away from moving parts and work.

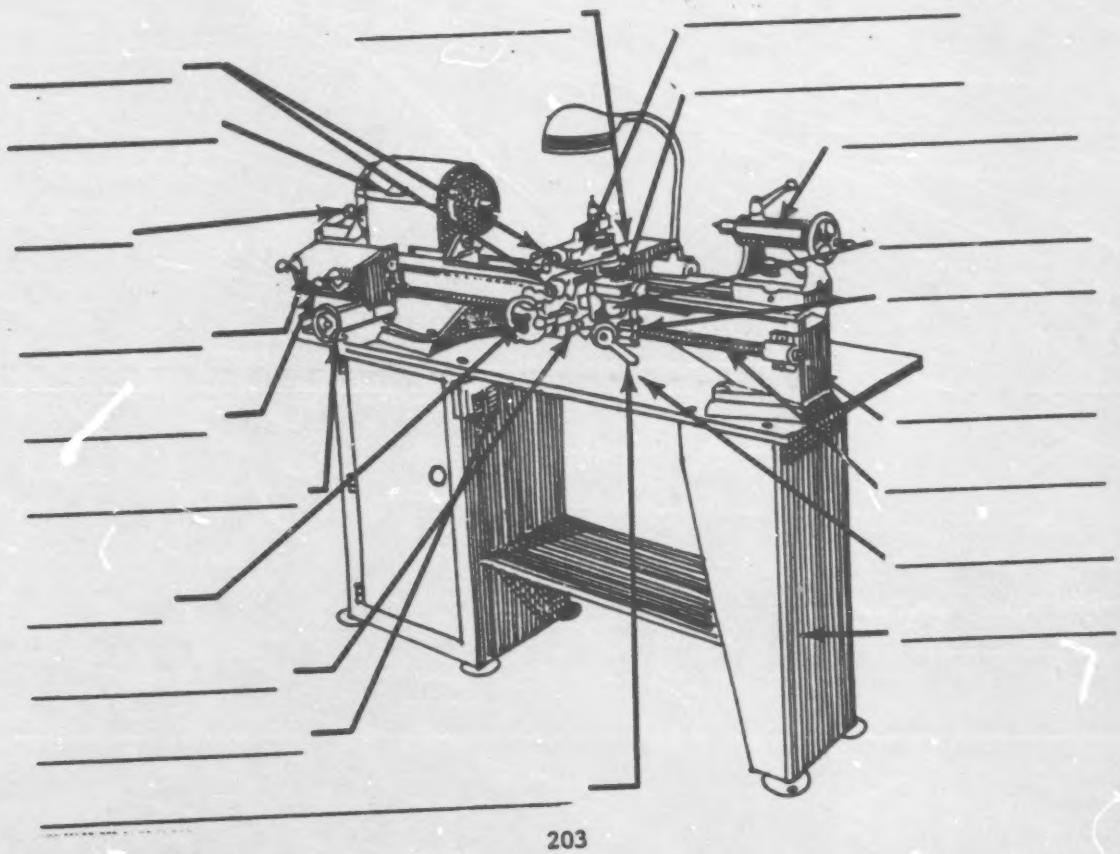


METAL LATHE

Student Name_____ _____
Class_____ _____
Date_____Grade_ _____

SAFETY QUIZ

		T	F
1.	A brush should be used for removing chips.	T	F
2.	The tail stock need not be secure to the bed.	T	F
3.	The chuck wrench remains in the chuck when the machine stops.	T	F
4.	It is safe to turn machine by hand before starting.	T	F
5.	Measurements should be made while the machine is stopped.	T	F

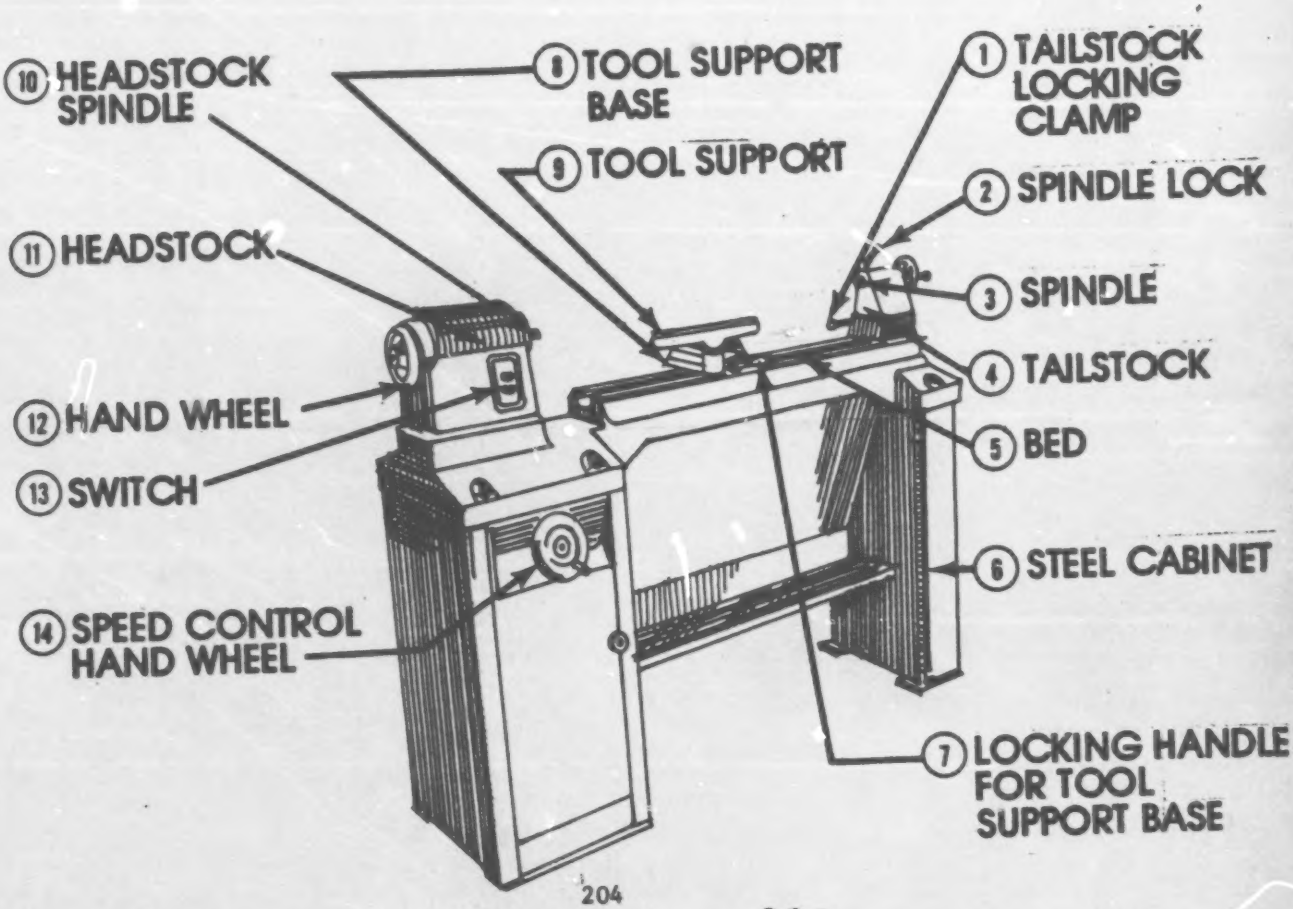


OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Wood Lathe

SAFETY SUGGESTIONS

1. Approved eye protection must be worn.
2. The tool rest must be close to the work when cutting tools are being used.
3. The cutting tools must be kept sharp.
4. Do not feel for smoothness of work while machine is running.
5. Work must be centered, balanced and secured.
6. The tool rest must be removed while sanding.
7. Examine setup before turning on power.
8. Shut off power while cleaning machine.
9. Long hair and loose clothing must be appropriately confined.

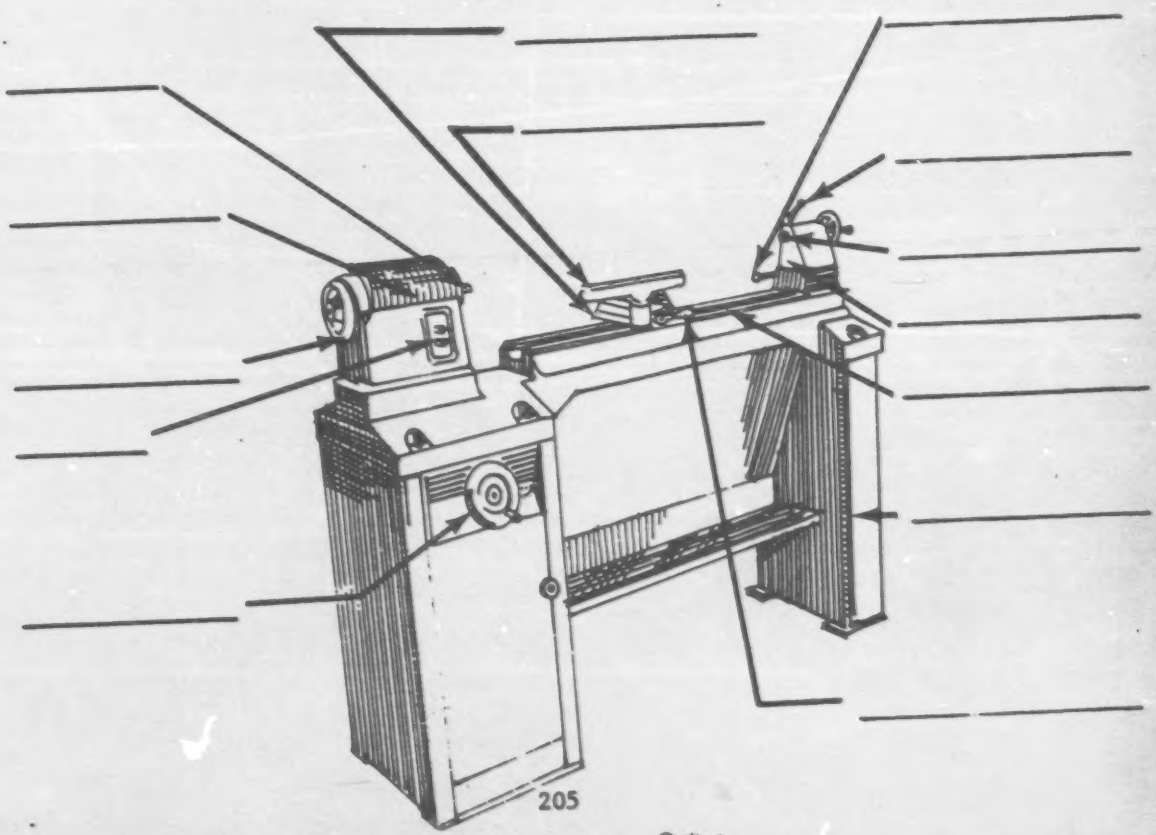


WOOD LATHE

Student Name_____ _____
Class_____
Date_____Grade_____

SAFETY QUIZ

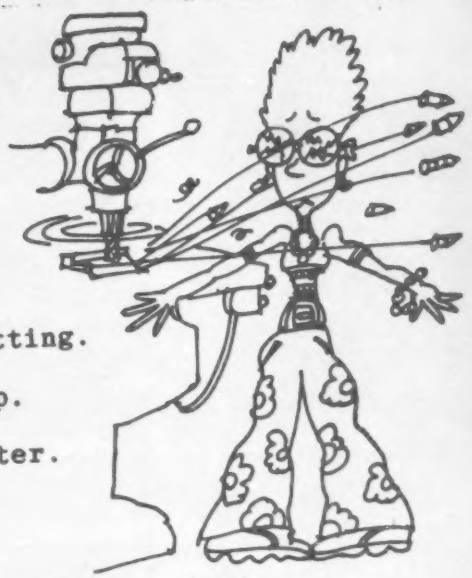
1.	The speed of the machine is not important for safe operation.	T	F
2.	A space of 1" is safe between the tool rest and the work.	T	F
3.	Eye protection is not necessary during operation.	T	F
4.	Dull tools may be used.	T	F
5.	It is safe to feel for smoothness while turning.	T	F
6.	The tool rest should be removed while sanding.	T	F
7.	It is safe to turn work that is not balanced.	T	F
8.	Long sleeves may be worn while operating.	T	F
9.	The cutting tools should be held loosely.	T	F
10.	The hair should be confined while operating the machine.	T	F



205

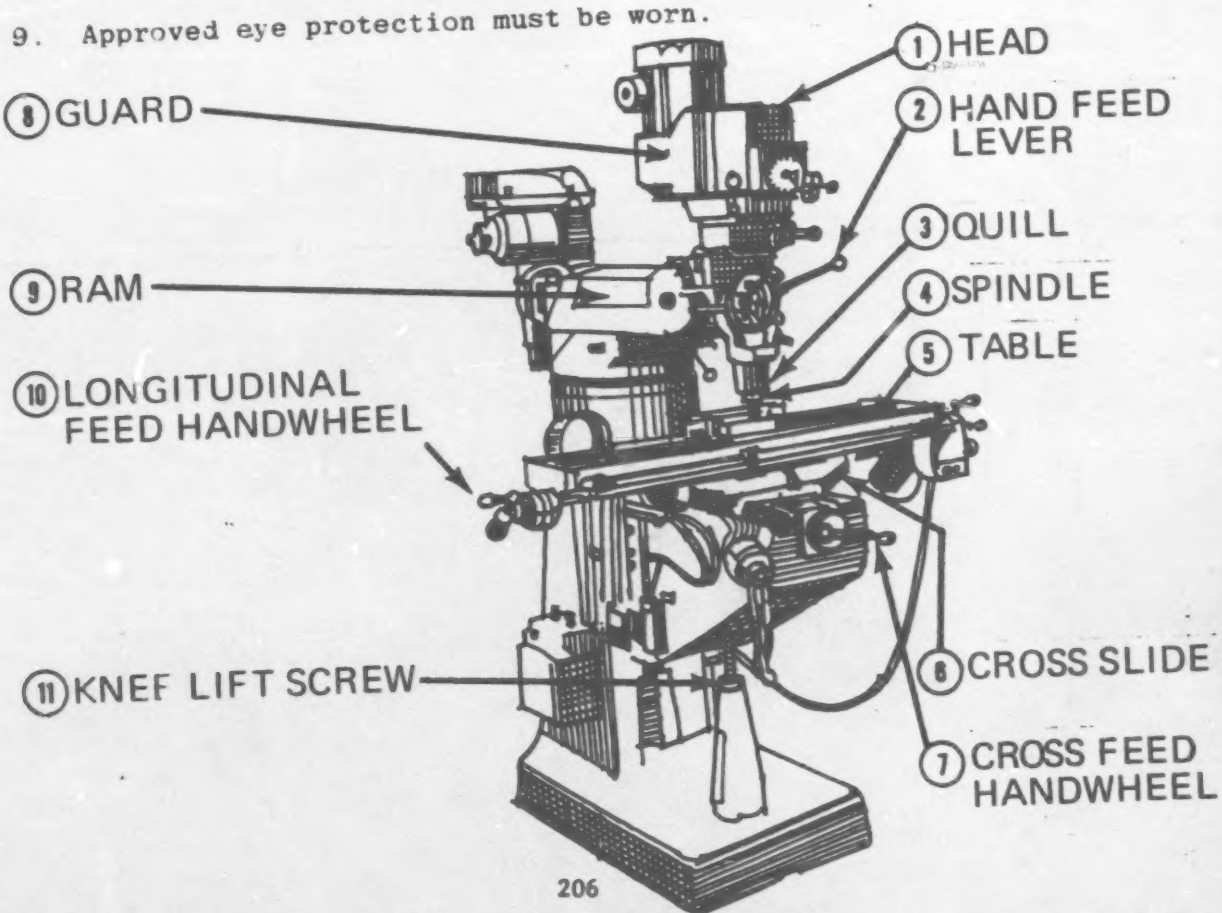
OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Milling Machine



SAFETY SUGGESTIONS

1. Make adjustments and measurements only when the machine is at a complete stop.
2. Material being machined must be properly secured.
3. Make sure the cutter is rotating in the right direction. Feed against the cutter unless the machine is capable of climb cutting.
4. Handle cutters carefully as they are sharp.
5. Keep fingers a minimum of 6" from the cutter.
6. Take care to prevent jamming the vise or the work into the column, cutter, etc.
7. Start your own machine and remain with it until you have turned it off and it has come to a complete stop.
8. Never clean chips away from cutter while machine is running.
9. Approved eye protection must be worn.

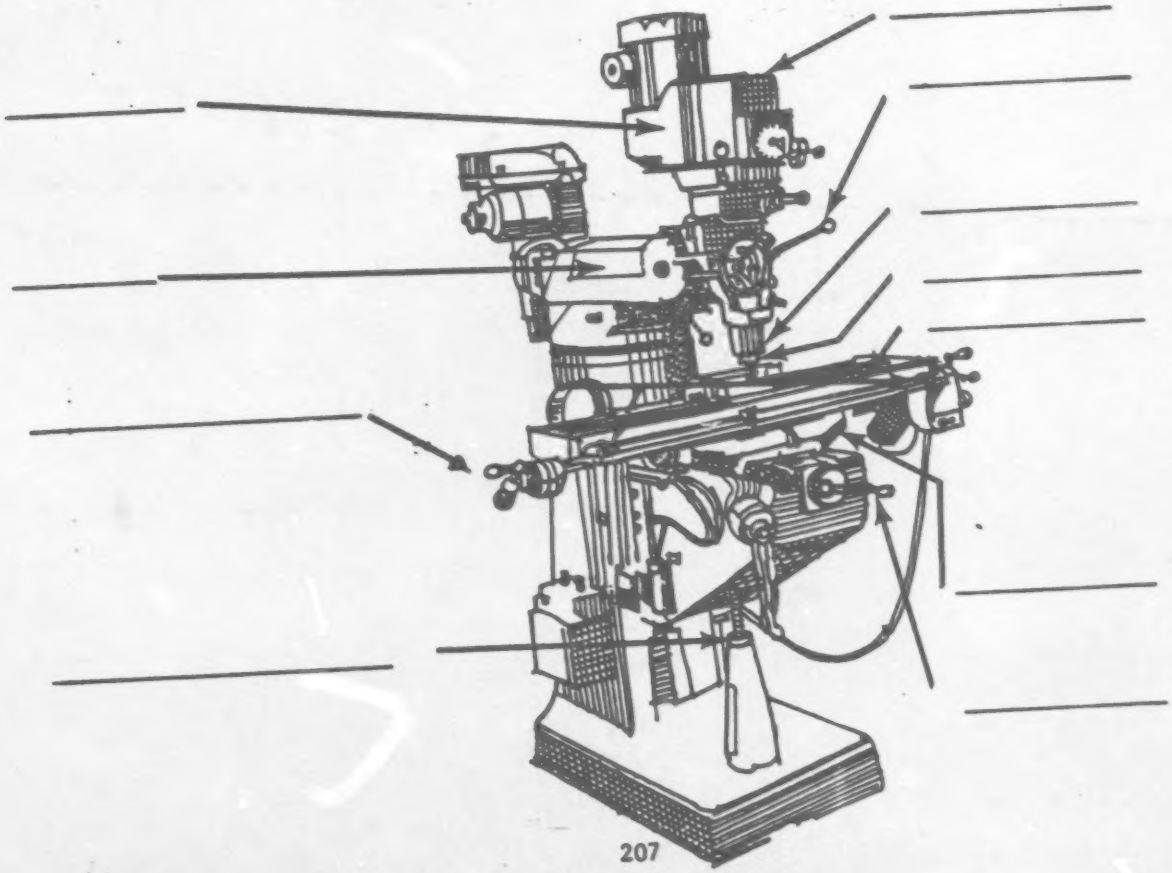


MILLING MACHINE

Student Name_____ _____
Class_____ _____
Date_____Grade__ _____

SAFETY QUIZ

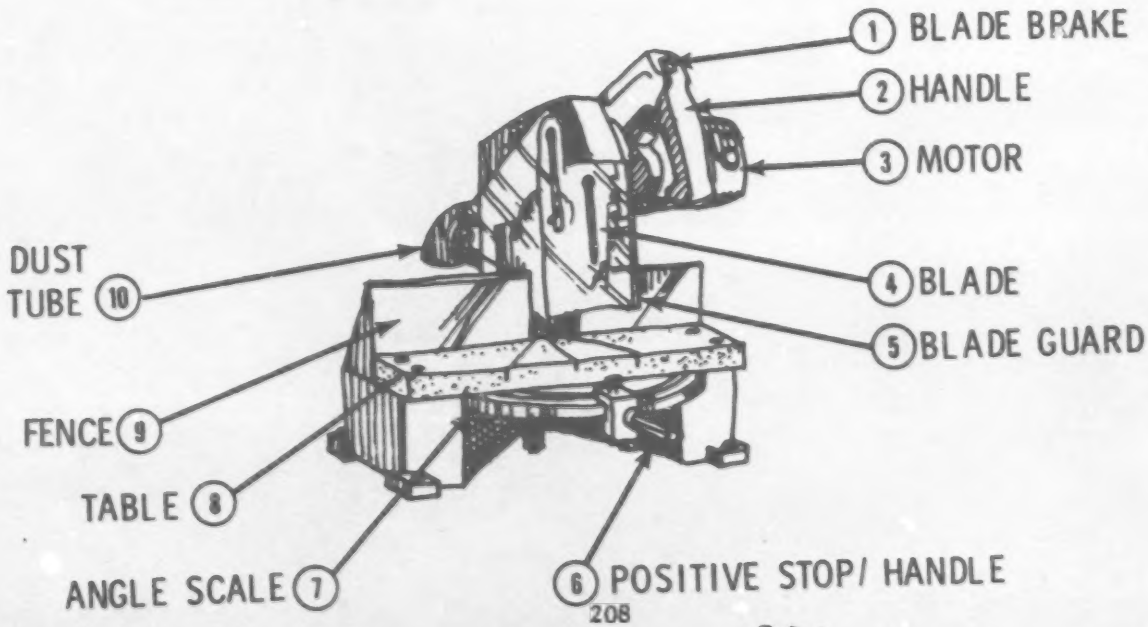
1. On long cuts it is permissible to leave the machine while on automatic feed. T F
2. Cutters should be stored loosely on the work bench. T F
3. Eye protection should be worn at all times. T F
4. Swarf chips can be wiped away with the hands. T F
5. The automatic rapid feed should not be used when the stock is closer than 6" from the cutter. T F
6. Handles should be disengaged when on automatic feed. T F



Motorized Miter Box

SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Be sure the power is disconnected before making angle adjustments or changing blades.
3. Always hold the work firmly against the fence and table.
4. Allow the motor to reach full speed before starting the cut.
5. Be sure the blade has stopped before removing scraps or chips from the work area.
6. Be sure the guard is functioning properly.



MOTORIZED MITER BOX

Student Name_____ _____
Class_____ _____
Date_____ _____Grade_____ _____

SAFETY QUIZ

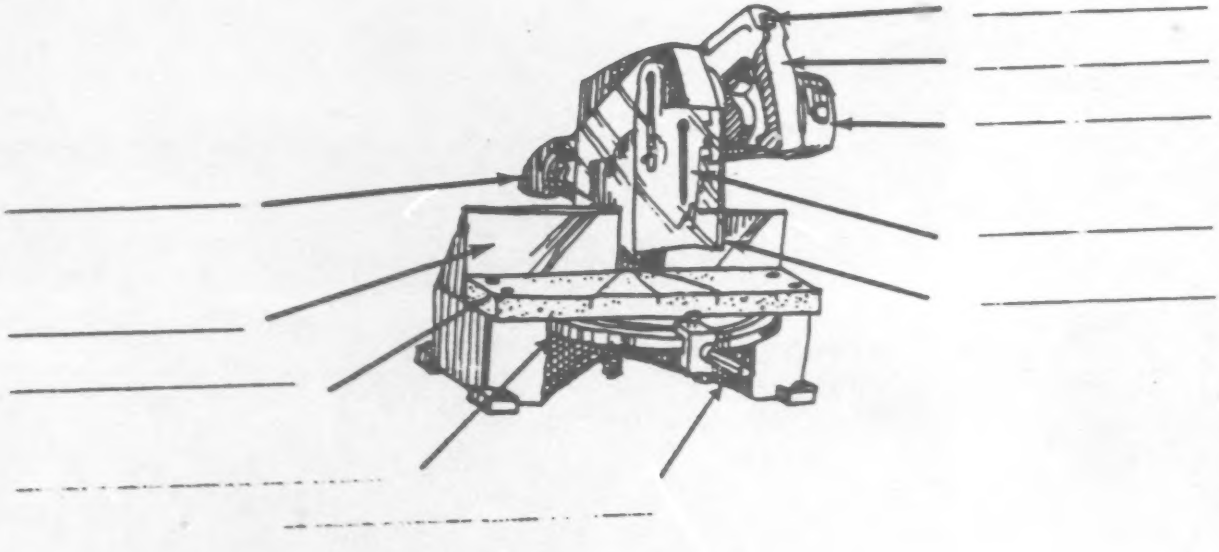
1. The guard must be used when making cuts with the motorized miter box. T F

2. It is not necessary to turn off the power when making adjustments or changing blades. T F

3. When making a cut the material being cut must be held firmly against the fence and table. T F

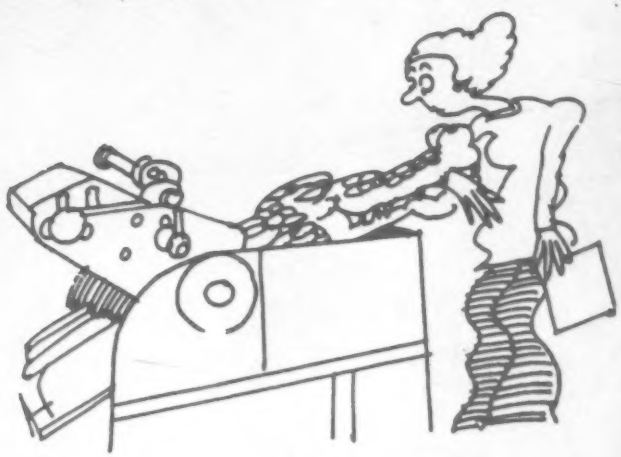
4. It is not necessary to allow the motor to reach full speed before starting a cut. T F

5. It is not necessary to wear eye protection when using the motorized miter box. T F



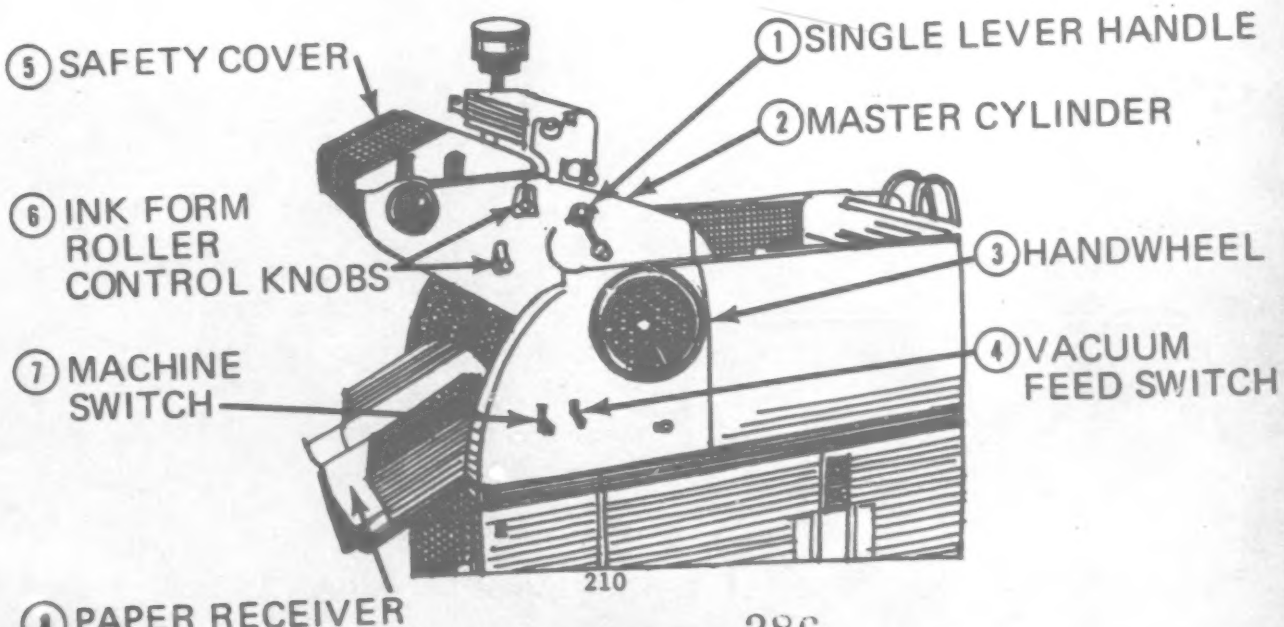
OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Offset Printing Press



SAFETY SUGGESTIONS

1. Operate the press only when all guards are in place and properly adjusted.
2. Never reach for misprinted or dropped paper while the press is in operation.
3. Do not make internal adjustments while the press is in operation.
4. Do not clean the press while it is in operation.
5. The instructor should determine the operating speed.
6. Never reach across the press while it is in operation.
7. When finished with the press, it must be clean and all paper, equipment and tools must be returned to proper storage.



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OFFSET PRINTING PRESS

Student Name_____
Class_____
Date_____ Grade_____

SAFETY QUIZ

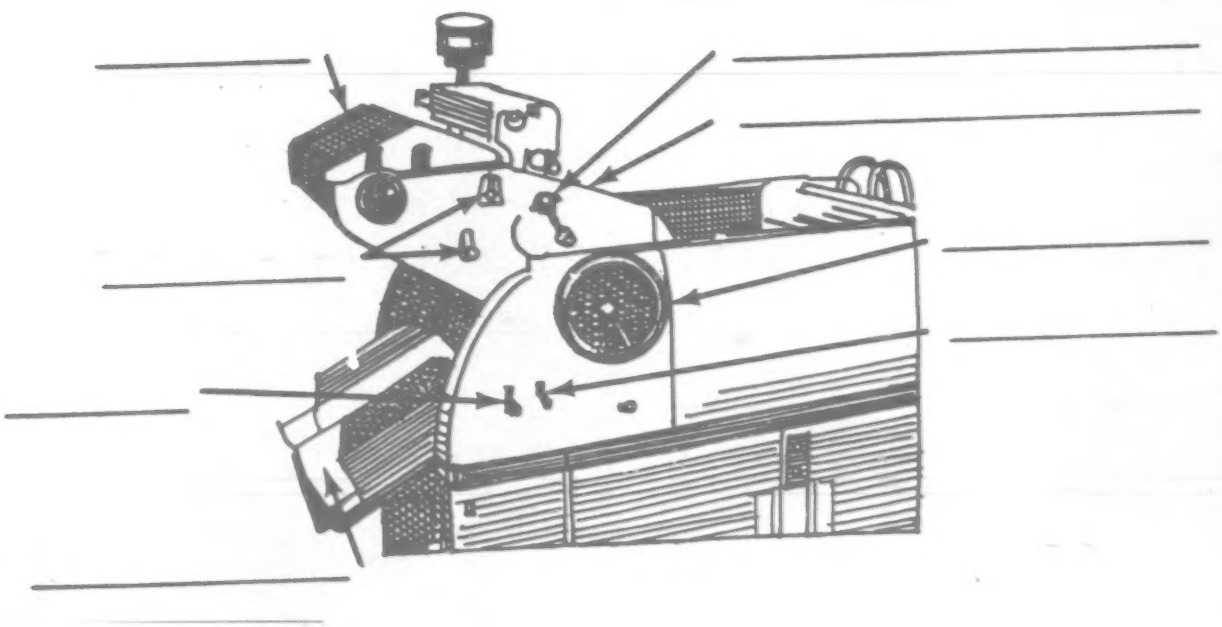
1. The gears need not be covered while the press is in operation. T F

2. The machine must be stopped before misprinted or dropped paper is removed from the press. T F

3. Final adjustments may be made while the machine is running. T F

4. You should be alert to keeping others away from the press while it is in operation. T F

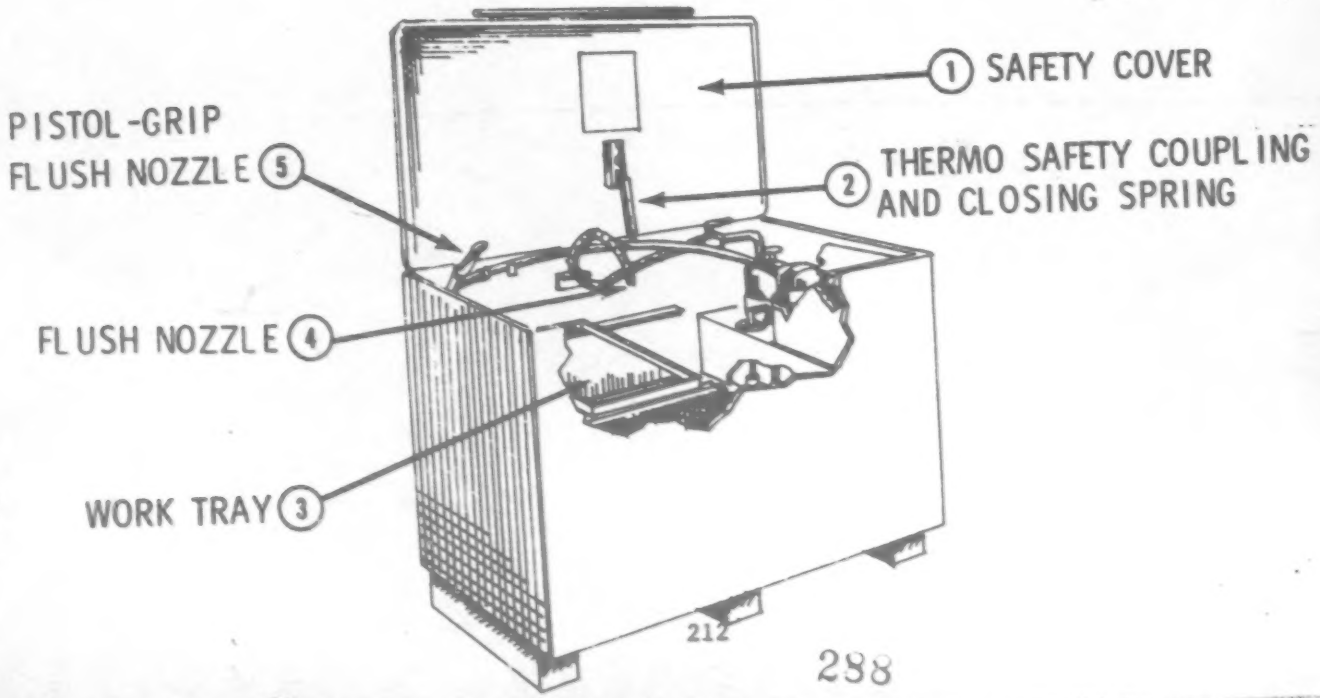
5. It is safe to reach across the press when it is operating. T F



SAFETY SUGGESTIONS

1. Use in well-ventilated area.
2. Wear approved goggles or face shield.
3. Use cleaning solvents with relatively high flash points (temperature at which vapors will ignite when brought into contact with an open flame.
4. Do not spill or splash solvent on clothing.
5. When brushing parts in solvent, use a nylon or brass bristle brush to avoid sparks.
6. A large tank of solvent must have a lid that is held open by a fusible link (holding device that will melt and drop the lid in the event of fire).

7. Wash hands and arms thoroughly when cleaning job is complete.
8. Avoid prolonged skin exposure to all types of solvents.



PARTS WASHER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

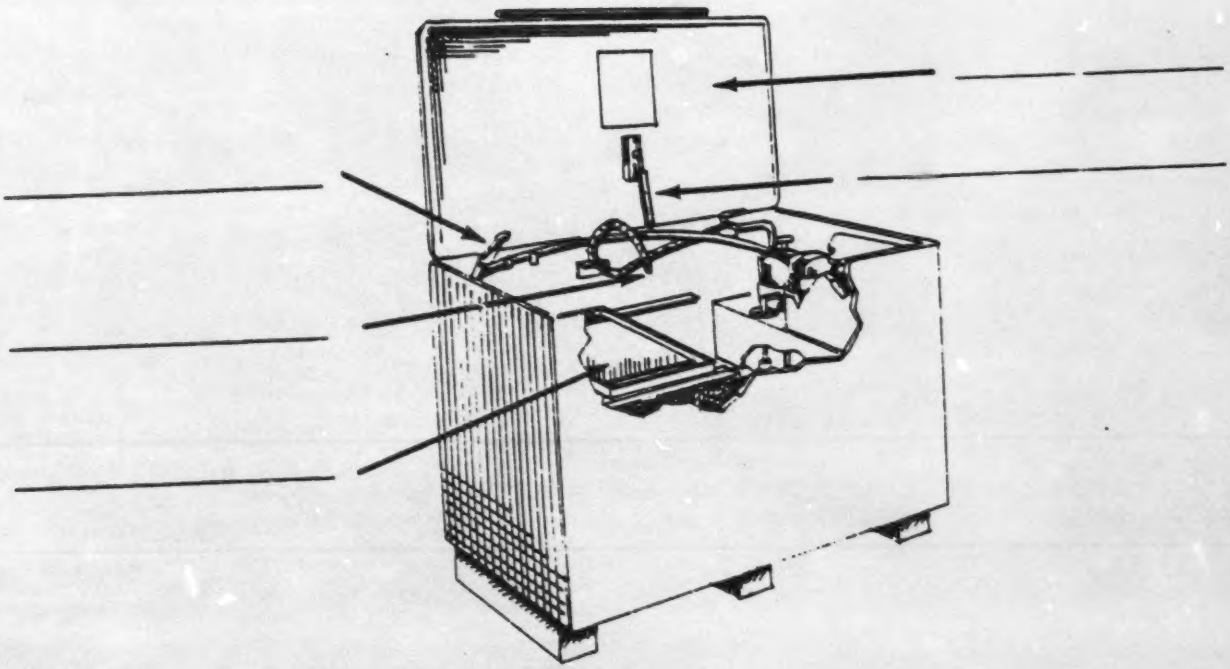
1. When brushing parts in solvent, a nylon or brass bristle brush should be used to avoid sparks. T F

2. It is not necessary to wear goggles or a face shield when washing parts. T F

3. A fusible link to hold the lid open is not necessary on parts wash tanks. T F

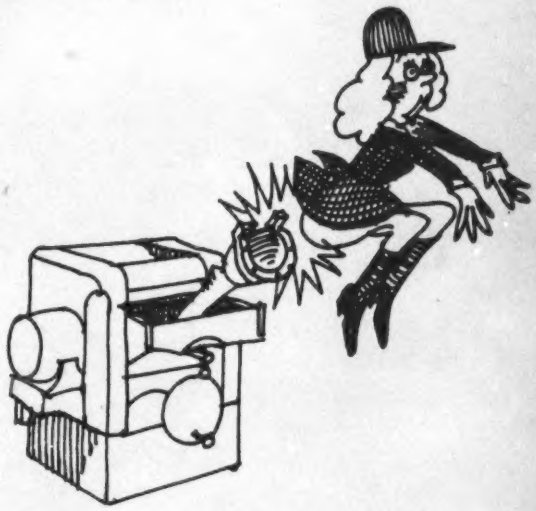
4. Parts wash tanks should be placed in a well ventilated area. T F

5. It is not necessary to wash your hands after washing parts in solvents. T F



OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Planer-Surfacer



SAFETY SUGGESTIONS

1. Approved eye protection must be worn.
2. A "backer board" should be used when planing thin stock.
3. Do not force material through planer.
4. Do not remove chip accumulation while machine is running.
5. Do not stand directly behind the machine or in the line of kick back.
6. Do not look into the throat of the surfacer when it is running.
7. Be sure to select the proper speed and depth of cut.
8. The board being surfaced must exceed the minimum length established for that particular machine (check with instructor).

PLANER-SURFACER

Student Name_____ _____
Class_____ _____
Date_____Grade_ _____

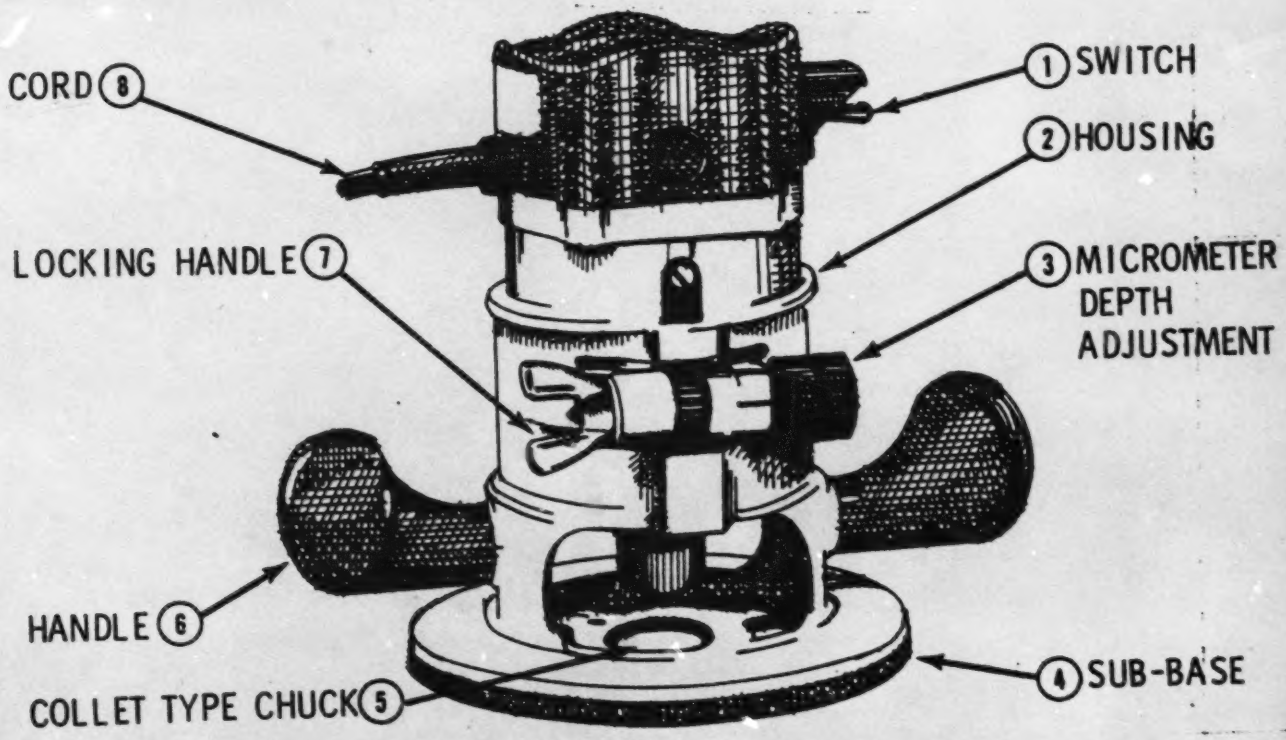
SAFETY QUIZ

1.	Instructor's permission is required to operate the machine.	T	F
2.	Eye protection is required to operate machine.	T	F
3.	Chips may be removed while machine is running.	T	F
4.	It is safe to plane wood with loose knots.	T	F
5.	If material becomes stuck, it is safe to stop machine.	T	F
6.	Line of sight should be through the throat of the machine.	T	F
7.	Assistance should be obtained when planing long pieces of wood.	T	F

Portable Router

SAFETY SUGGESTIONS

1. Remove jewelry, eliminate loose clothing, and confine long hair.
2. Always use approved eye protection.
3. Be sure switch is off before inserting plug into power source.
4. Be sure collet chuck is tight and bit is secure.
5. Be sure the work piece is clamped or rigidly held and the area of router travel is free of obstructions.
6. Hold router with both hands and cutting pressure should be constant. Do not force or jam into work.
7. Make a trial cut in a piece of similar scrap material.
8. Disconnect from power source when changing bits, making adjustments, or when router is not in use.

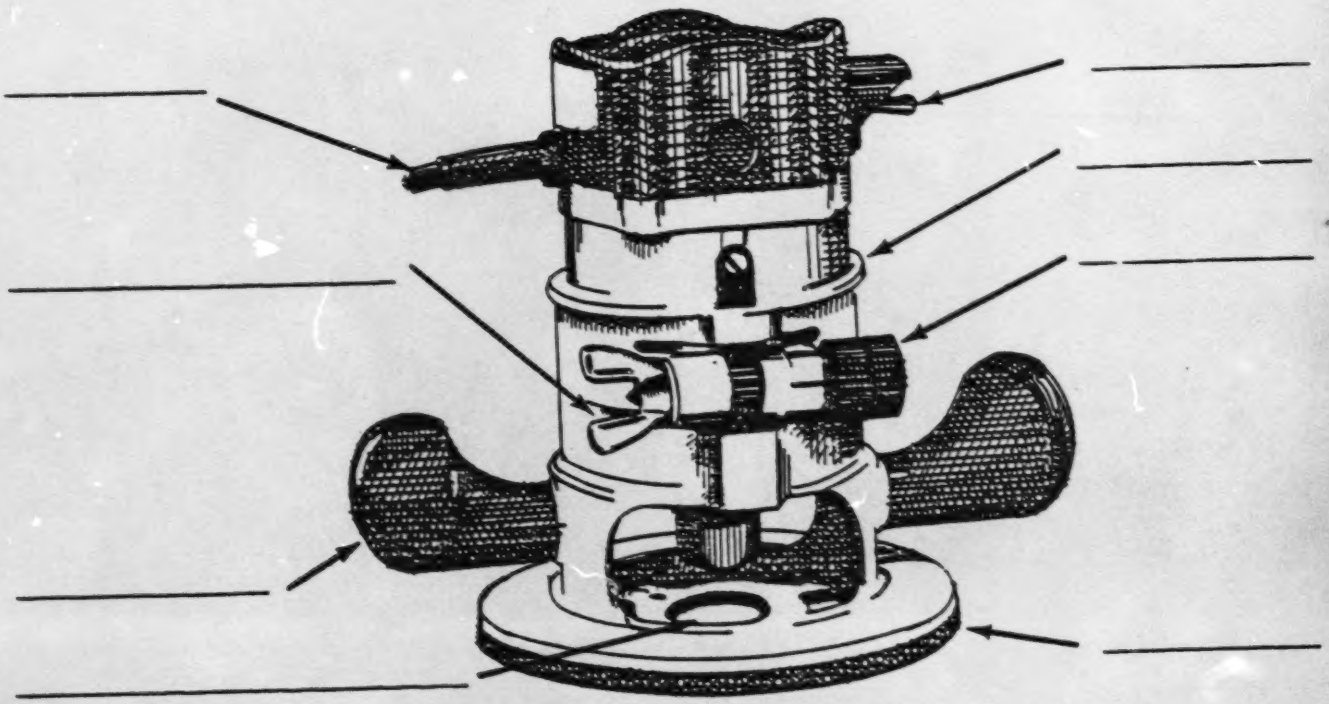


PORTABLE ROUTER

Student Name_____ _____
Class_____ _____
Date_____Grade___ _____

SAFETY QUIZ

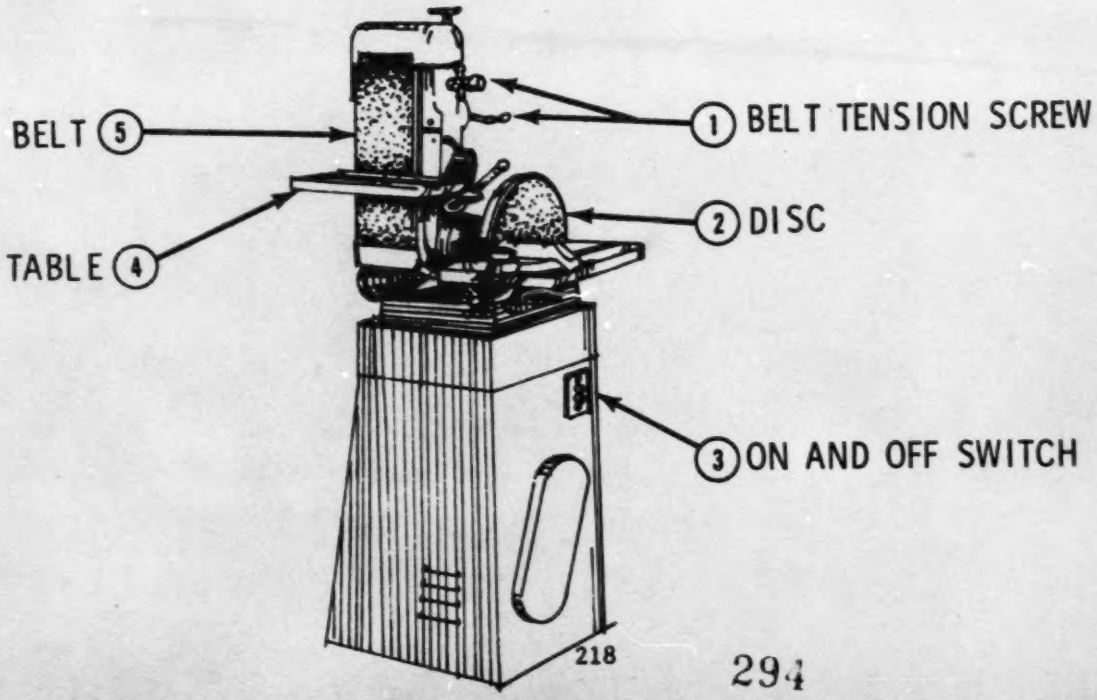
1. A trial cut in a piece of scrap wood should be made before cutting the material being used in the project. T F
2. The router is held with one hand only while cutting. T F
3. The router must be disconnected from the power source when changing bits. T F
4. The material being cut may be hand held. T F
5. The switch must be in the "off" position before inserting the plug into the power source. T F



Sander, Belt & Disc

SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Inspect the sanding belt and disc to be sure that they are properly installed and in good condition before starting machine.
3. Use moderate pressure and move the material being sanded back and forth to avoid heating and burning.
4. Keep hands and fingers at least one inch away from the moving belt and disc.
5. Put the material being sanded on the table and sand only on the downstroke half of the disc sander.
6. Long hair and loose clothing must be appropriately confined.

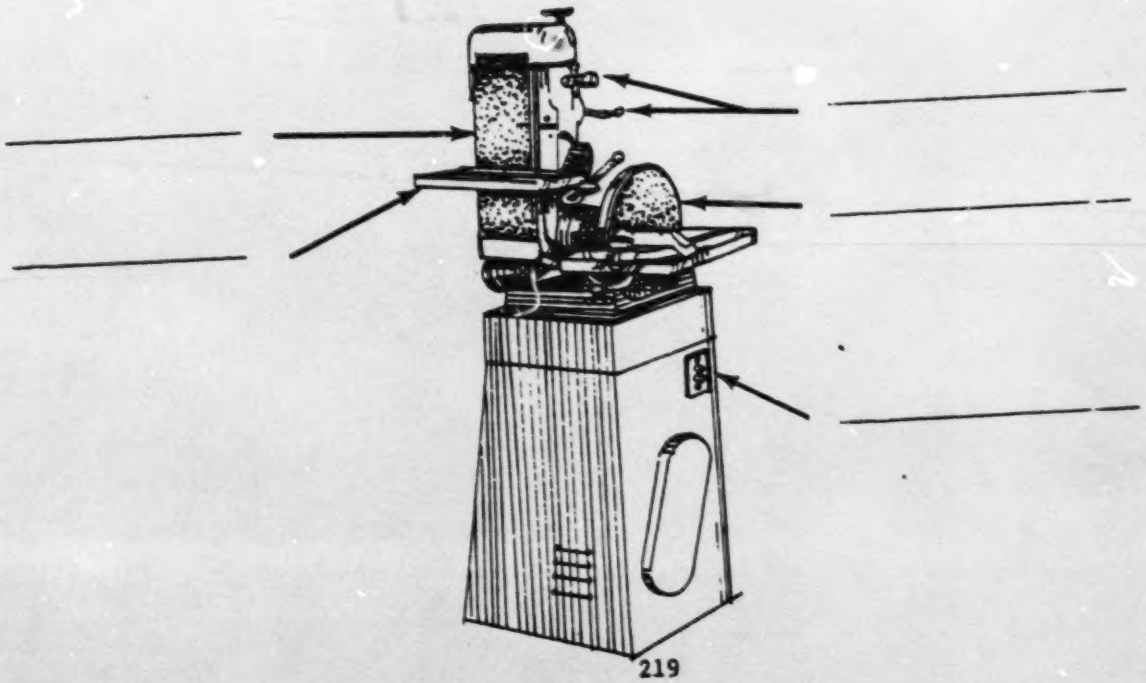


SANDER, BELT & DISC

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	Long hair and loose clothing are problems around the belt and disc sander.	T	F
2.	Moderate pressure should be used when sanding material on the belt and disc sander.	T	F
3.	Hands and fingers should be at least one inch away from the moving belt and disc.	T	F
4.	Eye protection need not be worn when using the belt sander.	T	F
5.	The belt guard may be removed when the machine is in operation.	T	F



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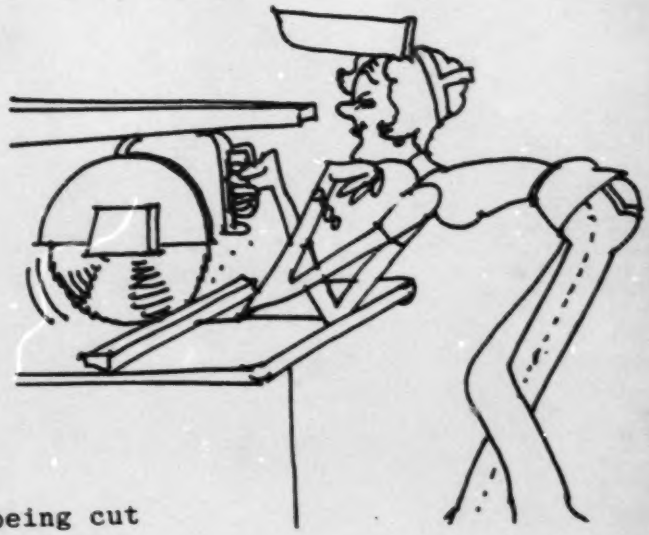
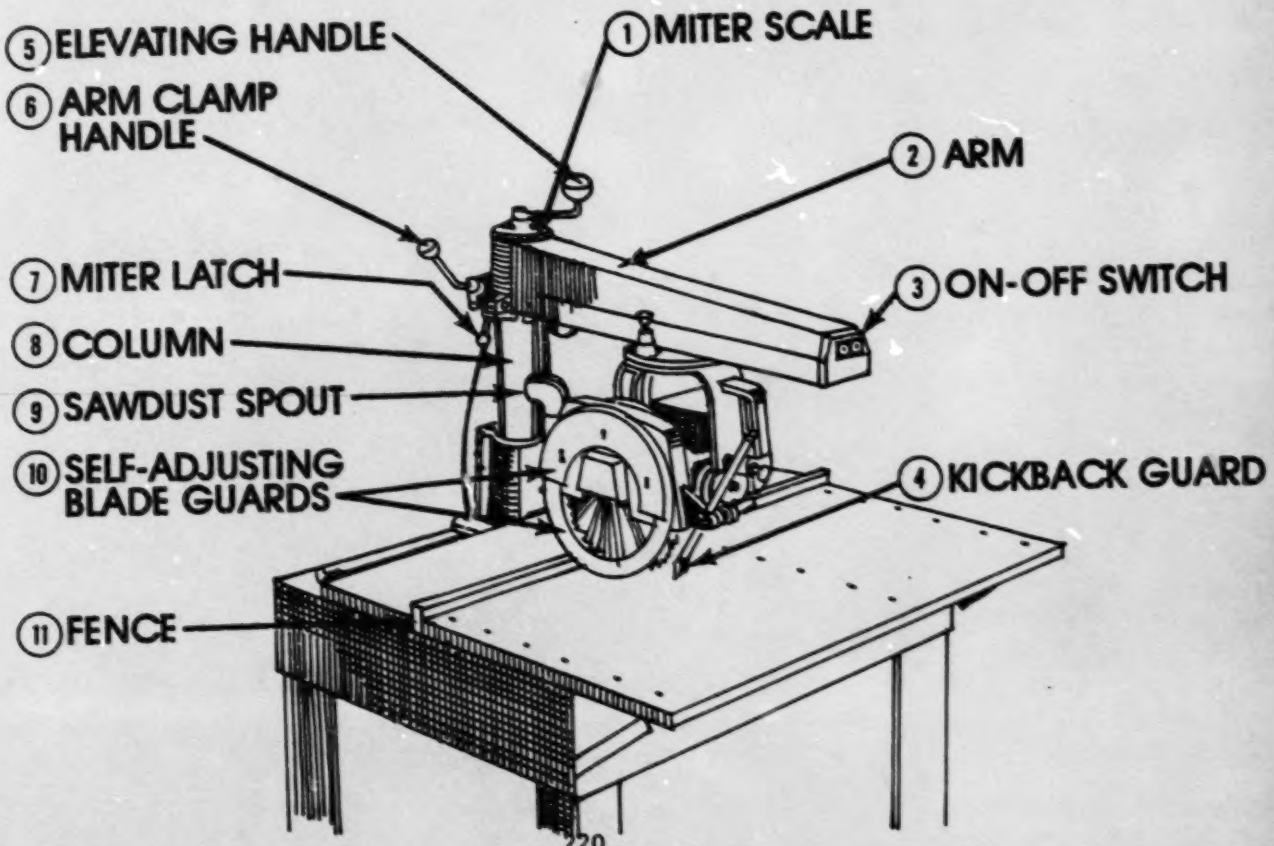
OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Radial Arm Saw

SAFETY SUGGESTIONS



1. Be sure that the saw travels easily on the arm.
2. Be sure that the blade will not extend beyond the front of the table.
3. Before starting make sure that the guard telescopes properly.
4. Make sure that the blade is stopped before leaving the machine.
5. Make sure that the material being cut is tight against the fence.
6. Approved eye protection must be worn while operating this machine.
7. Be sure the saw returns to the rear of the table at the completion of the cut.



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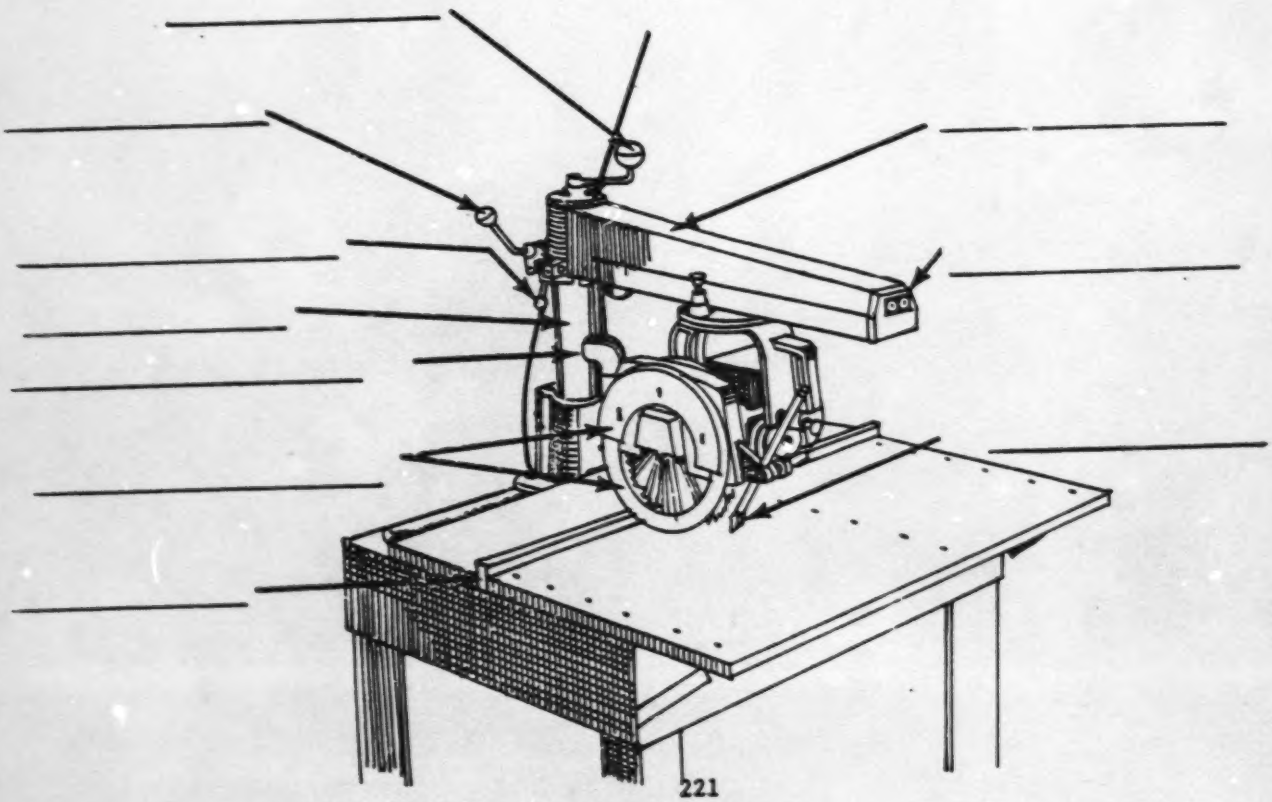
RADIAL ARM SAW

Student Name_____
Class_____
Date_____ Grade_____

SAFETY QUIZ

1. Eye protection is not necessary except when ripping.	T	F
2. You may leave the machine as soon as you have pushed the "off" switch.	T	F
3. The guard must be in place when ripping.	T	F
4. The saw blade may extend beyond the table.	T	F
5. The blade should be installed so that in cross cut position the teeth at the bottom of the blade point away from the operator.	T	F
6. When ripping, one hand must hold the material and the other hand operate the saw.	T	F
7. In cross cutting, the saw should automatically return to the rear of the radial arm upon the completion of a cut.	T	F



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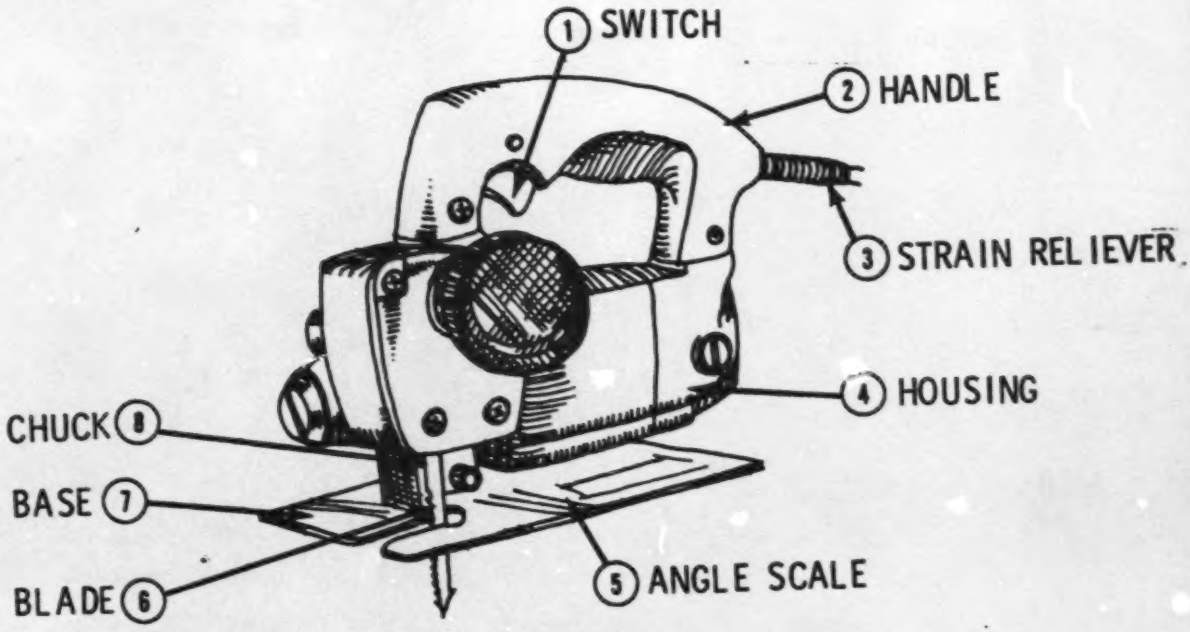
SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Be sure the blade is the correct type for the material being cut.
3. Be sure the switch is off before connecting to the power source.
4. Do not force the blade into the work; use a steady, even pressure.
5. Always keep the saw base tight against the material being cut.
6. Be sure the material being cut is tightly clamped or secured.
7. Be sure the saw blade is properly secured in the chuck.

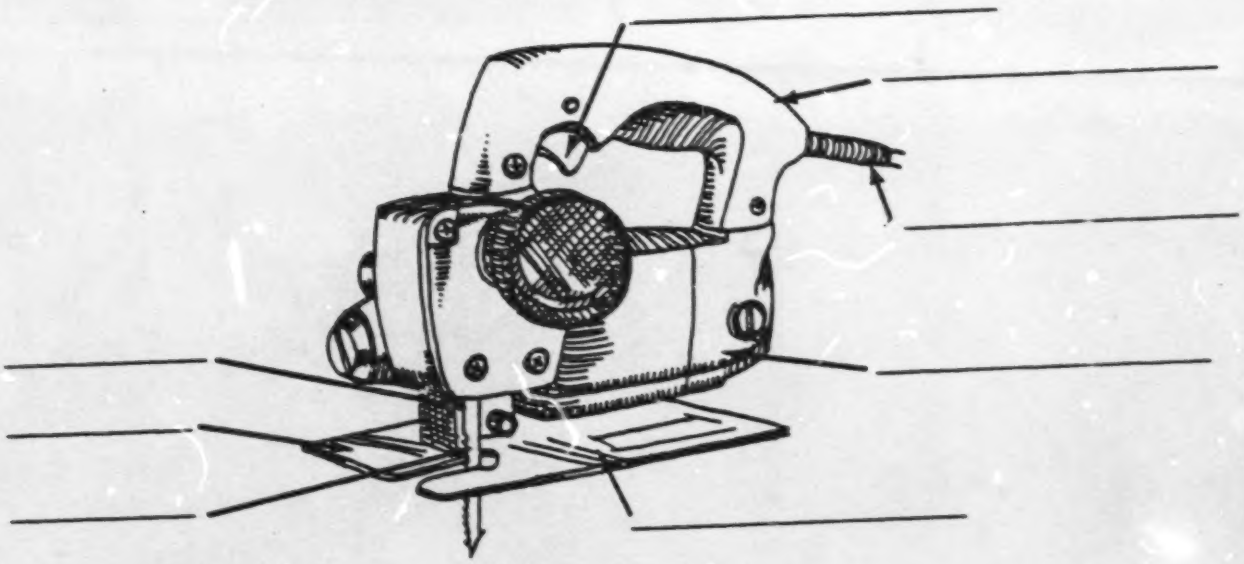


SABRE SAW

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	It is not necessary to wear eye protection when using the saber saw.	T	F
2.	The switch should be in the "on" position when connecting the electrical cord plug into the power source.	T	F
3.	When cutting, the blade should not be forced into the material being cut.	T	F
4.	There are several types of blades available for use in the saber saw.	T	F
5.	The material being cut must be tightly clamped or secured.	T	F



SCROLL SAW

Safety Instructions

1. Obtain permission from your teacher before using the scroll saw.
2. Cut only stock with a flat surface on bottom.
3. Make adjustments only when machine is at a dead stop.
4. Make sure the saw blade is the proper size for the job.
5. Check blade for correct tension.
6. Adjust hold-down so it will be as close as possible to the work.
7. Turn machine by hand to make sure all parts are clear.
8. Make sure that no one but you is inside the operator's zone.
9. Select correct machine speed.
10. Wear face shield or safety glasses (goggles, spectacles).
11. Turn on power after permission is given.
12. Hold material firmly.
13. Feed the material into the machine at a moderate rate of speed.
14. Keep fingers away from saw and hands out of the path of saw.
15. Report mechanical defects or a broken blade to your teacher.
16. Turn off power after using scroll saw and stand by until the machine has stopped.
17. Clear away scraps of wood on the table only after saw stops running.

Safety Test Questions

I

( ) 1. You should install the scroll saw blade to cut: (a) on the down stroke of the saw; (b) at minimum speed; (c) on the up stroke of the saw; or (d) on both the up and down strokes of the saw.

( ) 2. Before you start the scroll saw, you should check the hold-down adjustments to make certain: (a) there is a half-inch clearance between it and the stock; (b) it is as close as possible to the work; (c) the correct size of blade is installed; or (d) it is against the table.

( ) 3. Prior to starting the scroll saw, you should turn machine by hand to be sure: (a) saw blade teeth point upward; (b) hold-down moves up and down; (c) the beginning cut is on the line marked on stock; or (d) all moving parts are clear.

( ) 4. Stock to be cut on the scroll saw should be: (a) soft; (b) hard; (c) flat on the bottom; or (d) round on the bottom.

( ) 5. You should feed stock into scroll saw: (a) in rhythm with motion of hold-down; (b) at a rate dependent upon pulley speed; (c) as fast as possible; (d) at a moderate rate of speed.

II

_____ 1. You should install scroll saw blade so it will cut on the _____ stroke.

_____ 2. After installing scroll saw blade, you should check blade for correct _____.

_____ 3. To ensure that all moving parts are clear after making adjustments on the scroll saw, you should turn machine by _____.

_____ 4. Stock to be cut on the scroll saw should have a flat surface on the _____.

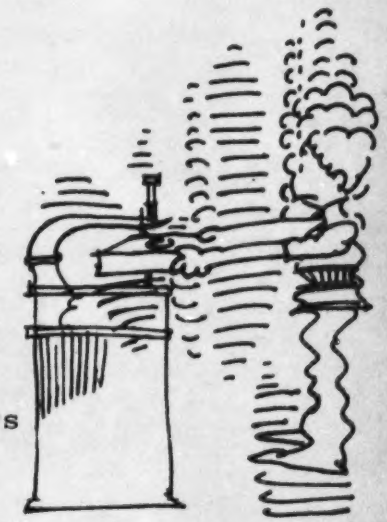
Answers to Test Questions

I. 1. (a); 2. (b); 3. (d); 4. (c); 5. (d)

II. 1. downward (down); 2. tension; 3. hand; 4. bottom

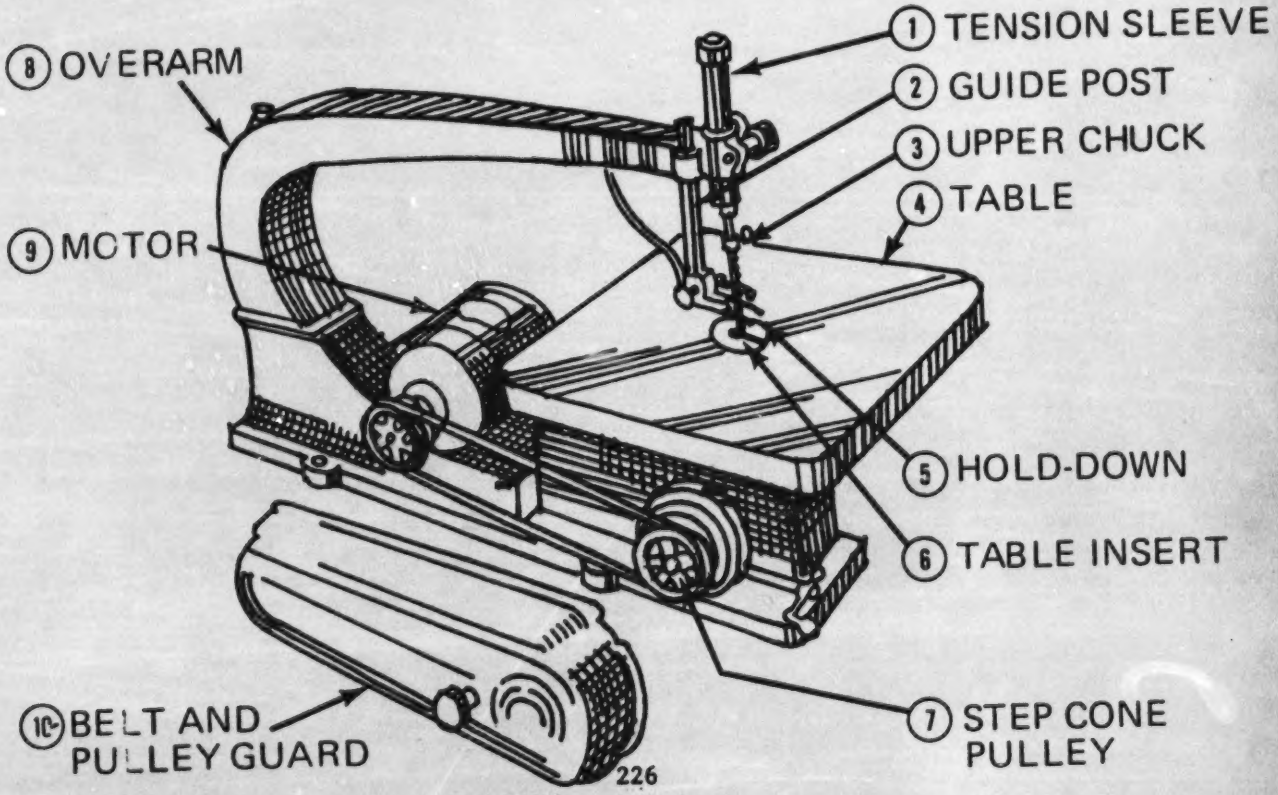
OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Scroll Saw



SAFETY SUGGESTIONS

1. Approved eye protection must be worn while operating this machine.
2. Make all adjustments before turning on scroll saw.
3. Lower the hold-down so that the spring fingers bear lightly on the work.
4. The danger area is within the "line of cut". Hold work piece with both hands on either side of the "saw line".
5. Shut off power and clean the machine before you leave it.
6. Avoid overloading the machine by feeding the stock too fast.
7. Avoid pinching the blade by turning too sharply.



SCROLL SAW

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. If the blade pinches in the kerf do not stop the machine. T F

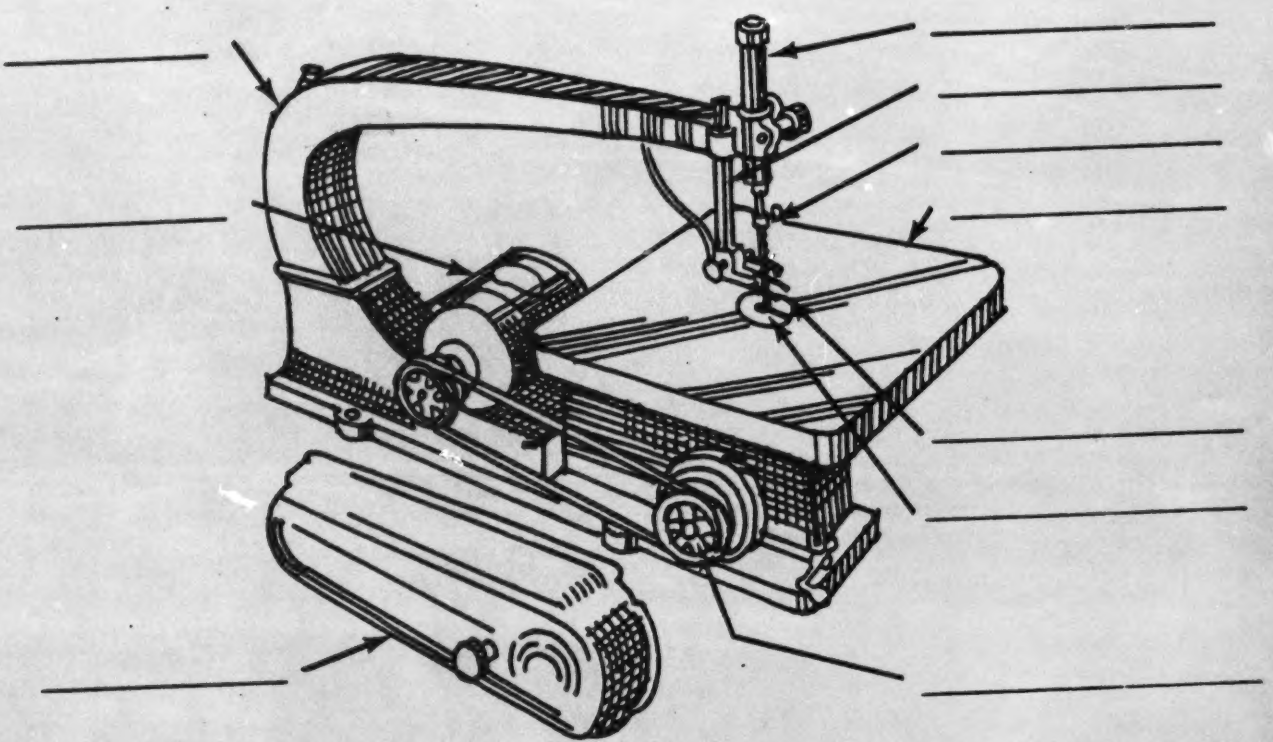
2. Eye protection must be worn. T F

3. It is not necessary to have the flat side of the stock next to the table. T F

4. Fingers should be kept away from the line of cut. T F

5. Adjustments may be made while the saw is running. T F

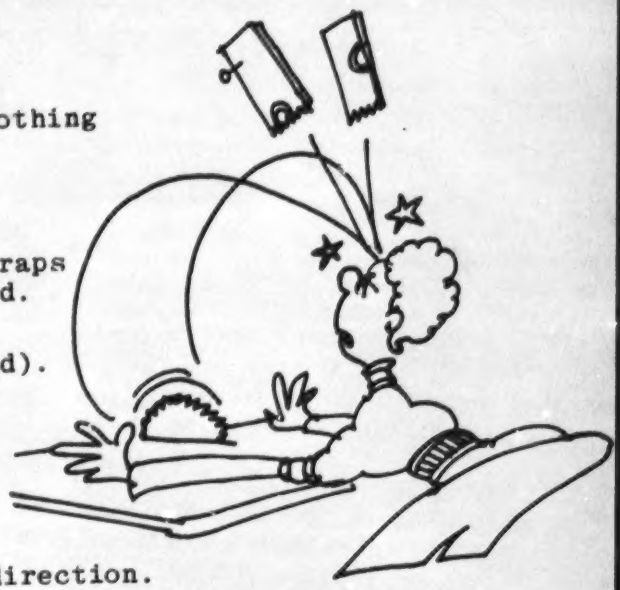
6. The hold-down should bear lightly on the work. T F



OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Table Saw

SAFETY SUGGESTIONS



1. Wear approved eye protection.
2. Remove jewelry, eliminate loose clothing and confine long hair.
3. Use properly secured and adjusted guards at all times.
4. Make all adjustments and remove scraps with the machine completely stopped.
5. Select proper blade and set at correct height (1/8 inch above wood).
6. Never saw freehand - never reach over the saw blade.
7. Stand to the side - not in line with the blade.
8. Make sure blade is installed with the teeth pointing in the proper direction.
9. A push stick should be used when the hands come within 3 inches of the blade.
10. Use the rip fence for ripping and miter gauge for crosscutting.
11. Stop the machine, lower blade below table, and clean up scraps when completed.

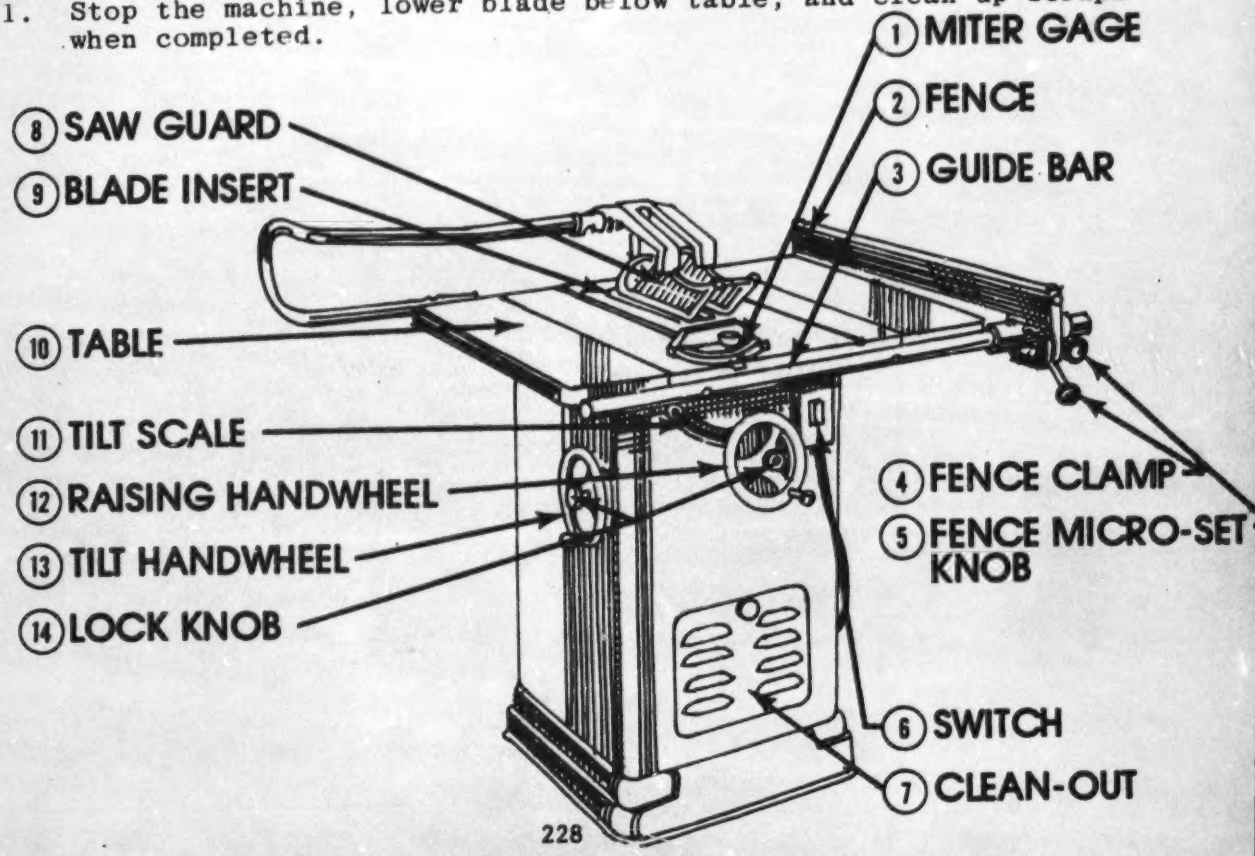


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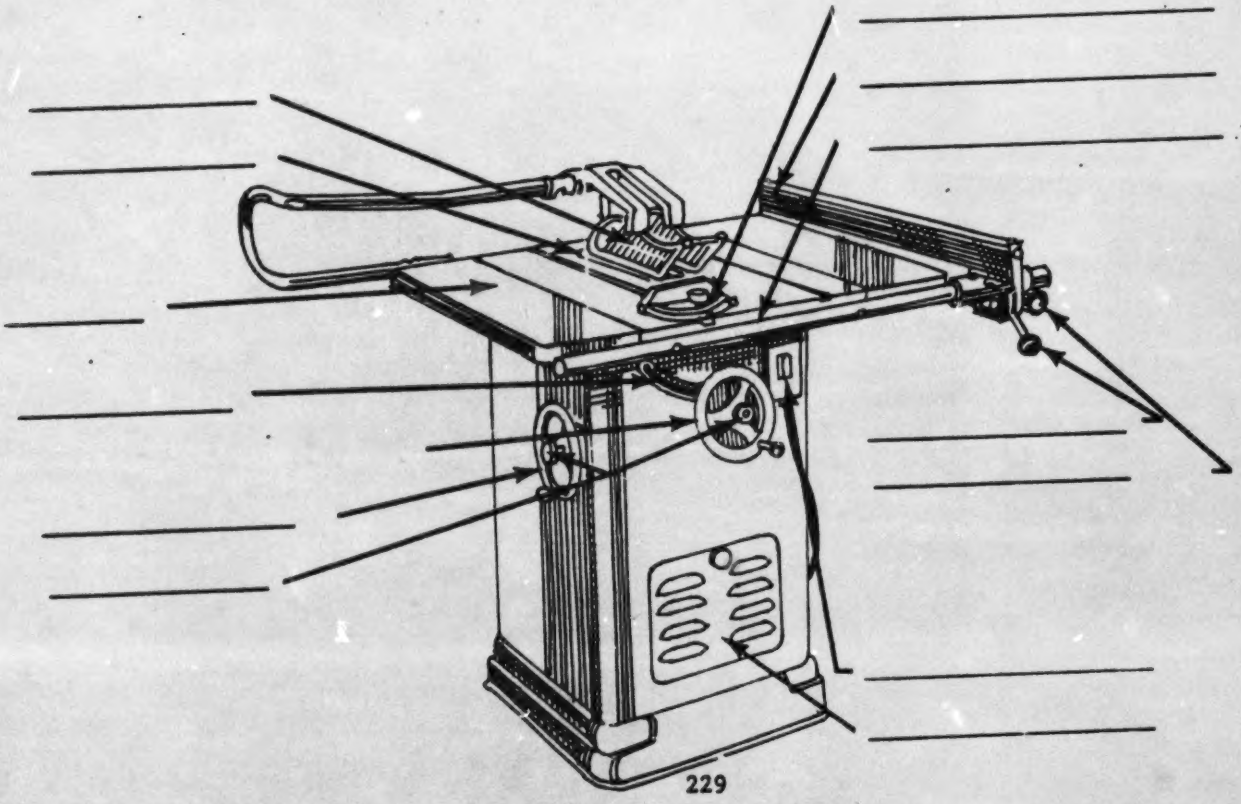
TABLE SAW

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	It is safe to saw freehand.	T	F
2.	The fence should always be used.	T	F
3.	The guard is not always necessary.	T	F
4.	When ripping it is best to stand directly behind the blade.	T	F
5.	Eye protection should be worn when using a table saw.	T	F
6.	The saw blade should be adjusted so that the teeth clear the thickness of material by the depth of the teeth.	T	F
7.	A helper or roller should be used when ripping long pieces.	T	F
8.	A push stick is necessary when ripping narrow stock.	T	F



OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THIS MACHINE.

Metal Shaper

SAFETY SUGGESTIONS

1. Wear approved eye protection.
2. Make adjustments and measurements only when the machine is at a complete stop.
3. Securely mount the work piece in the holding device.
4. Make certain that the ram and head will clear the work and holding devices.
5. Keep hands and fingers a minimum of 6 inches from the cutting tool and all other moving parts.
6. Avoid laying tools on the machine.
7. Avoid standing directly in front of or behind the ram.
8. Make sure machine comes to a complete stop before leaving it.
9. Never remove chips while the machine is in motion.
10. Return the machine to normal and all tools and equipment to the proper storage place.

METAL SHAPER

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. It is permissible to use compressed air to remove chips while the machine is running. T F

2. Eye protection must be worn. T F

3. A heavy cut may get the job done more quickly but also could be unsafe. T F

4. Chips may be removed while the machine is running. T F

5. All clearances should be checked before the ram is set in motion. T F

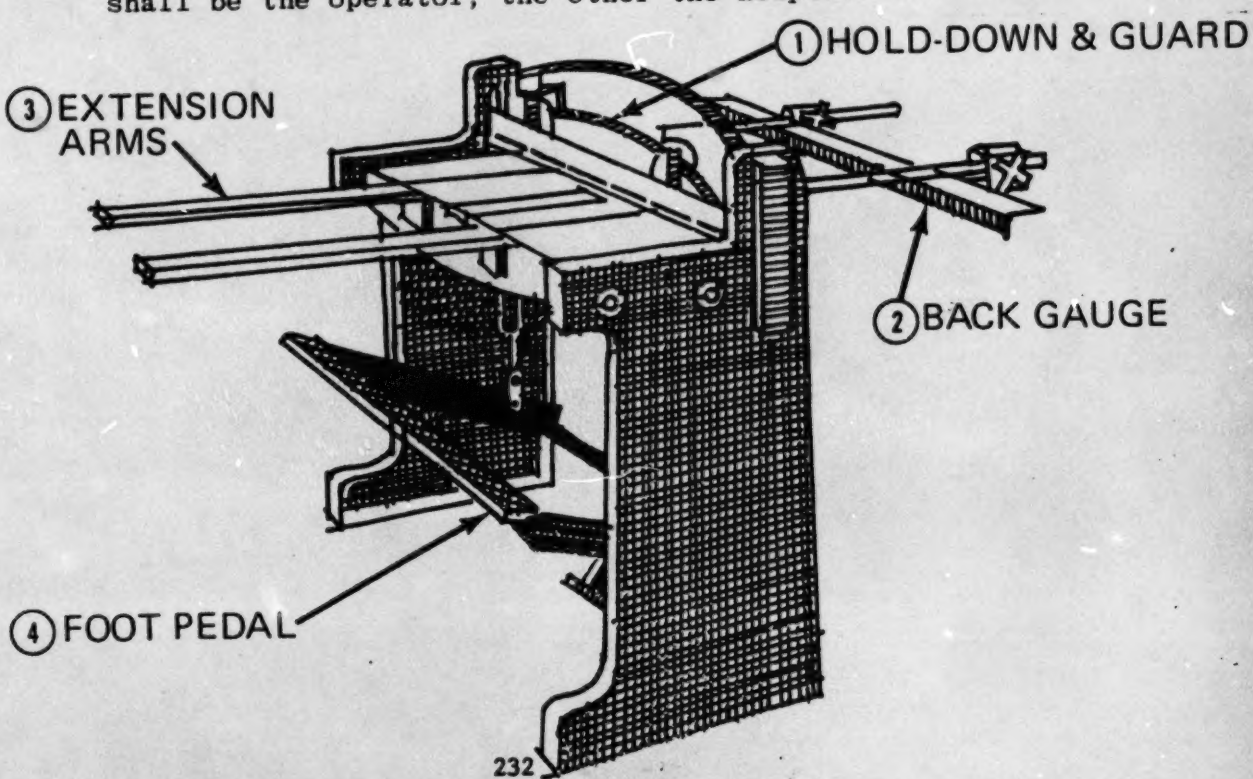
6. All set-ups should be approved by your instructor. T F

Metal Squaring Shear

OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

SAFETY SUGGESTIONS

1. Check setup and machine before operating.
2. Never surpass the capacity of the machine.
3. Feed and operate from the front or the operator's position.
4. Always keep your fingers away from the pressure bar and blade, a minimum of 4 inches.
5. Keep the foot that is not being used [illegible] from under the treadle.
6. Allow small pieces to drop; do not attempt to catch them.
7. Remove burrs before working; gloves or pads are recommended for handling sheet metal, especially large pieces.
8. Place scraps or trimmings in metal waste container and return machine to normal position.
9. Whenever two people are needed to operate the shear, one shall be the operator, the other the helper.



METAL SQUARING SHEAR

Student Name_____
Class_____
Date_____ Grade_____

SAFETY QUIZ

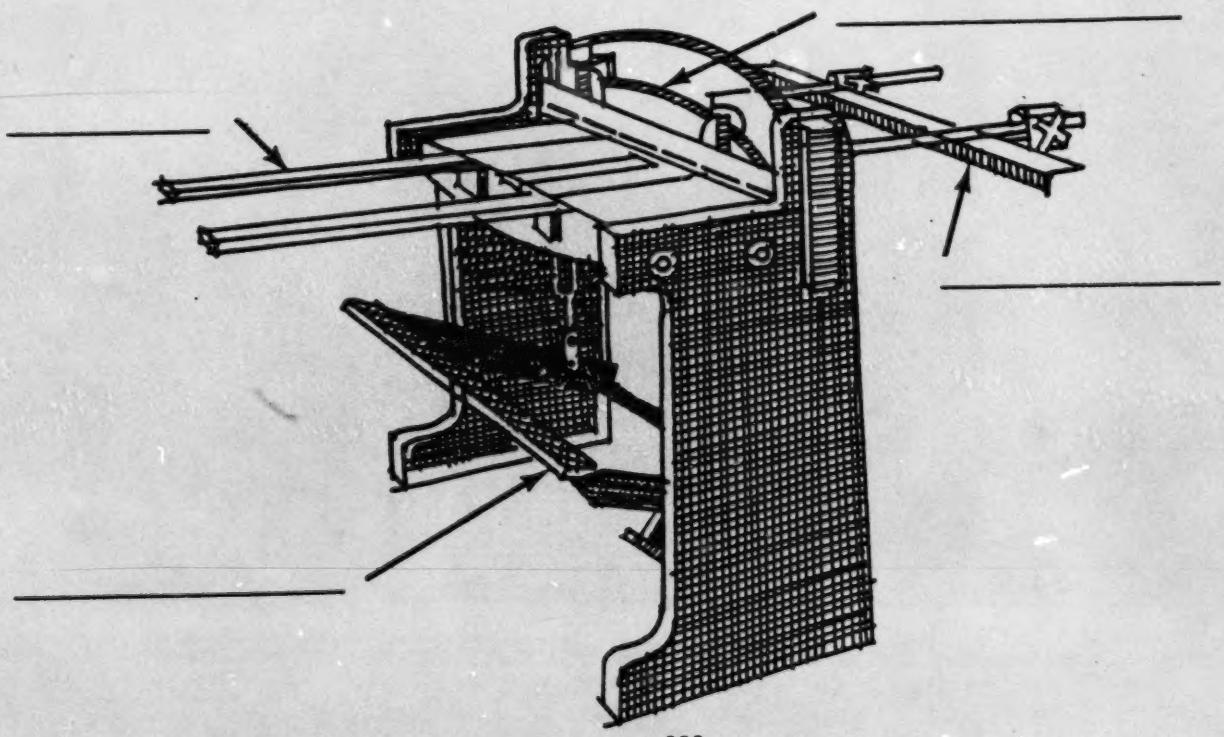
1. Feed and operate from the treadle side of the machine only. T F

2. It is permissible to let small pieces drop into a box as they are cut. T F

3. Two students may operate the shear together. T F

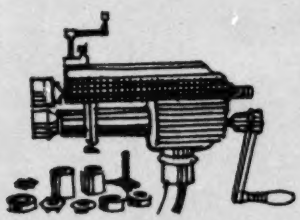
4. For some projects the guard can be removed. T F

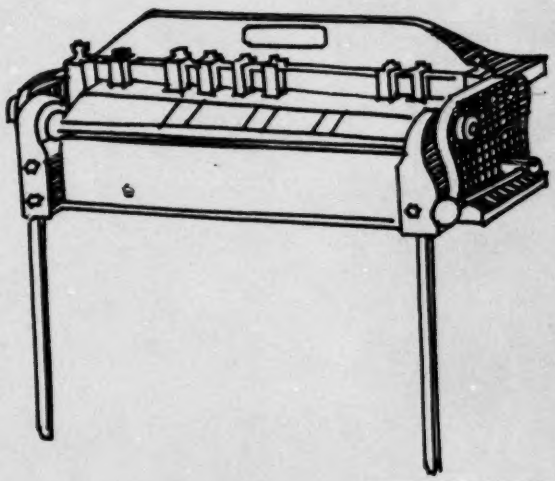
5. The foot treadle should be so arranged that there is a 2" floor clearance at the bottom of a stroke. T F



OBTAIN PERMISSION FROM THE INSTRUCTOR
BEFORE USING THESE MACHINES

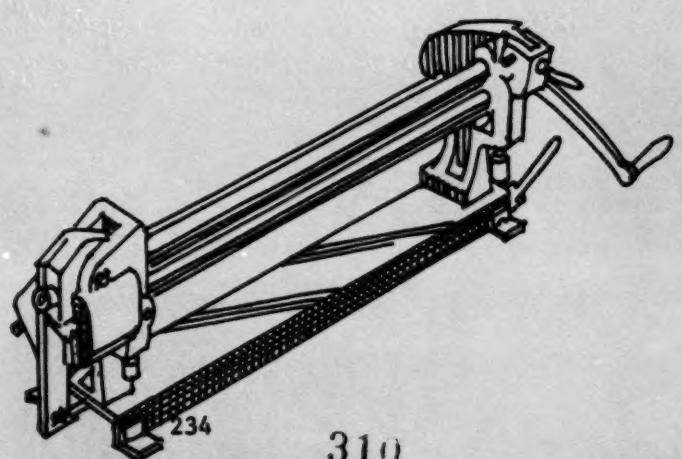
Sheet Metal Machines





SAFETY SUGGESTIONS

1. Remove sharp burrs and edges from sheet metal before attempting to work it in the machines.
2. Never attempt to bend, roll, crimp, bead, etc., metal which is heavier than the capacity of the machine.
3. Keep hands and fingers clear of moving parts.
4. Never work more than one thickness of metal at one setup.
5. Avoid slamming or dropping the handles of the machine.
6. Be careful that moving parts or metal do not strike others.
7. Take care not to place hands in a position that will allow them to slip into the rolls, jaws, etc.



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SHEET METAL MACHINES

Student Name_____ _____
Class_____ _____
Date_____Grade____ _____

SAFETY QUIZ

1. The infeed rolls of a roll machine are dangerous to the operator's hands. T F

2. Sheet metal machines can be damaged by overloading. T F

3. Sharp burrs and edges should be removed before attempting to place in the machine. T F

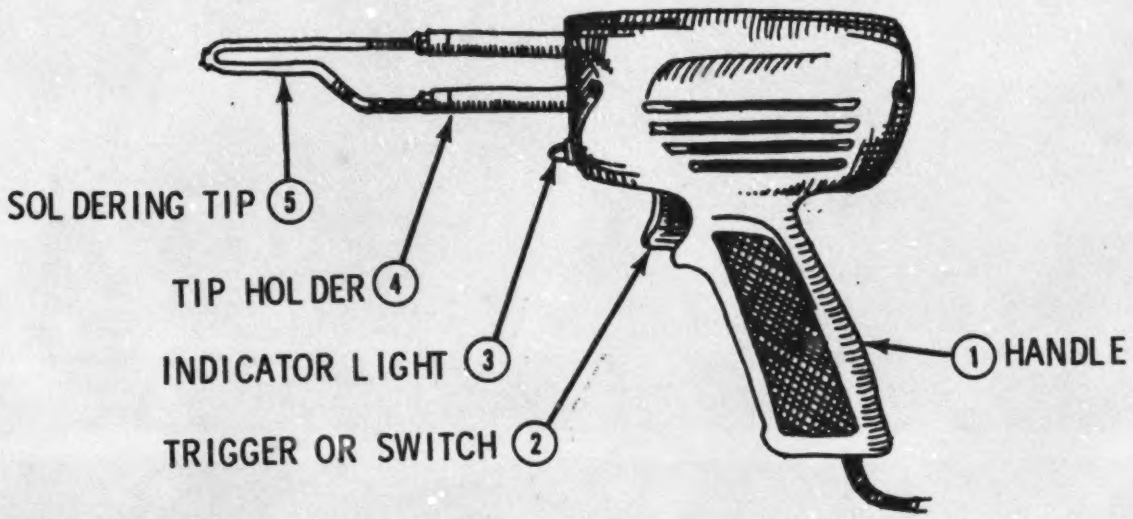
4. Fingers must be kept clear of moving parts. T F

5. Quarter inch mild steel stock can be formed on the sheet metal machine. T F

Solder Gun

SAFETY SUGGESTIONS

1. Always wear approved eye protection.
2. Work in a well-ventilated area and avoid inhaling soldering fumes.
3. Observe all rules for handling hot materials.
4. Do not flip excess molten solder off the tip of solder gun. Wipe it off with a piece of steel wool.
5. Do not stand in wet areas while using the solder gun.
6. Never leave the solder gun unattended with the electrical cord plugged in.
7. Always disconnect cord when changing soldering tips.
8. Soldering flux can cause burns. Clean up flux immediately.
9. In case of acid burns, flush immediately with water.

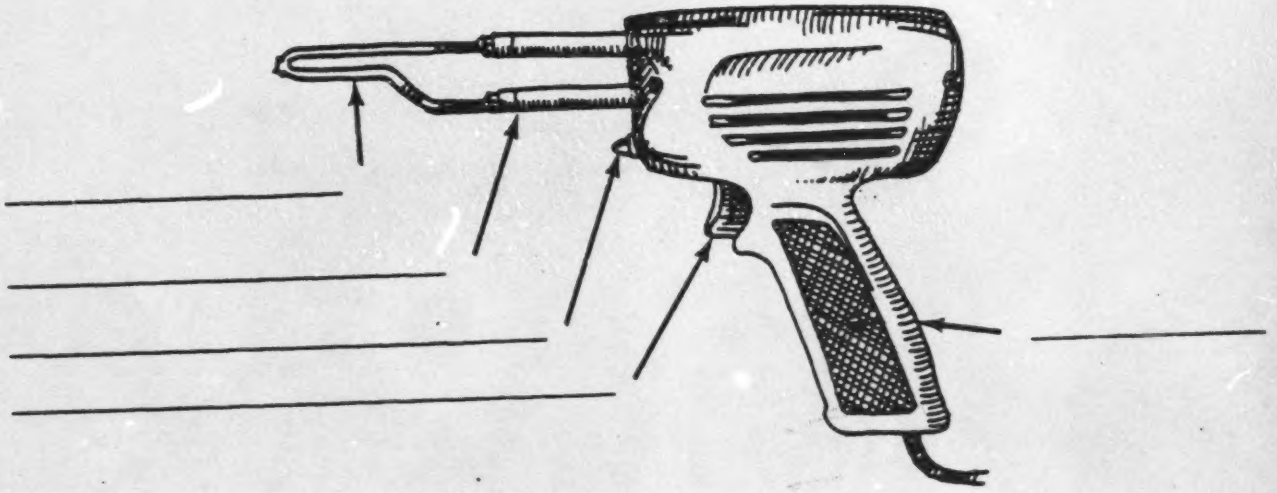


SOLDER GUN

Student Name_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1. Wear safety goggles ONLY if you think solder might flip in your eyes. T F
2. A large, airy room would be a better place to solder than a small closed space. T F
3. Use pliers or a clamp to hold small objects while soldering. T F
4. The most important thing to remember when changing soldering tips is to stand in a wet area. T F
5. Leave your work to cool and come back later to clean up the excess flux. T F



OPERATION CHECKLIST
OXY-ACETYLENE WELDER

1. Obtain permission from the teacher to use oxy-acetylene welder. ( )

2. Adjust welder for operation in following sequence:
   a. Inspect regulator's adjusting screws to insure that they are all the way out (counterclockwise). ( )
   b. Open oxygen cylinder (green) valve slowly. (wide open -- stand to one side) ( )
   c. Open acetylene cylinder (red) valve (¼ to ½ turn) ( )
   d. Open the torch oxygen valve one turn. ( )
      (1) Turn oxygen regulator valve adjusting screw until proper reading is obtained. (See chart for tip being used.) ( )
      (2) Turn off torch oxygen valve. ( )
   e. Turn the acetylene regulator adjusting screw in slowly until correct reading is obtained for tip being used. ( )

3. Lighting torch procedure:
   a. Turn torch acetylene valve 1/16 of a turn, then ignite acetylene gas coming from tip with spark lighter. ( )
   b. Readjust the acetylene regulator adjusting screw until the correct reading is obtained. ( )
   c. Turn acetylene torch valve on slowly until flame jumps away from tip, then slightly reduce the fuel supply to bring the flame back to the tip. ( )
   d. Adjust torch oxygen valve to obtain neutral flame. ( )

Do I understand the following operating instructions?

1. I must wear approved welding goggles when gas welding. Yes No
2. I must never lay down a lighted torch. Yes No
3. I must never use acetylene gas at a pressure greater than 15 lbs. per square inch. Yes No
4. I must be careful not to burn hoses. Yes No
5. I must replace goggles, hoses and torch in proper places and clean up area when I am through welding. Yes No
6. I must have teacher check my set up before lighting torch. Yes No

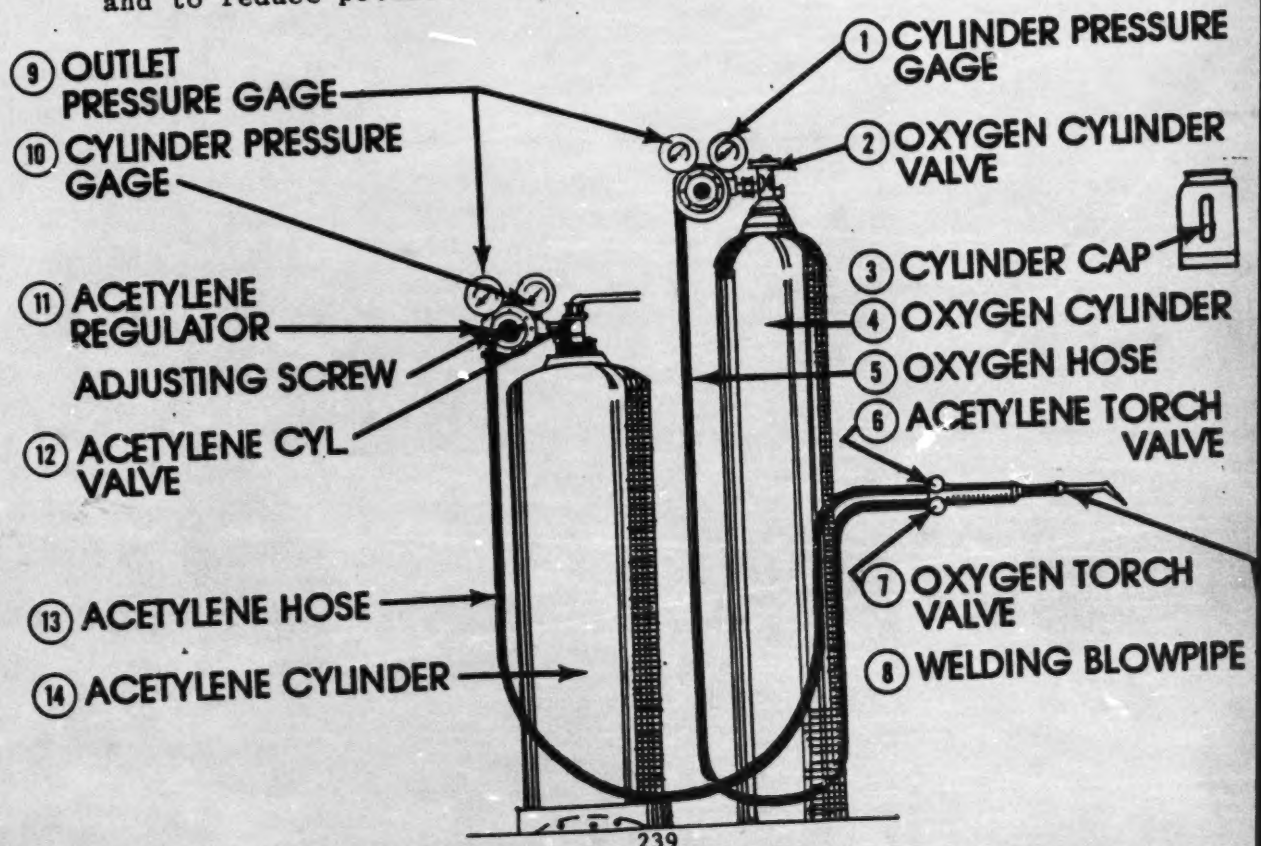
STUDENT'S NAME_____ TEACHER'S INITIALS_____

OBTAIN PERMISSION FROM THE INSTRUCTOR BEFORE USING THIS MACHINE.

Oxy-Acetylene Welder

SAFETY SUGGESTIONS

1. Do not weld galvanized metal without proper ventilation.
2. Do not allow oil to come in contact with hoses or equipment.
3. Gas bottles must be erect and secure at all times.
4. Approved goggles and spark-resistant clothing must be worn when welding.
5. Do not weld or cut on a closed container without instructor's approval.
6. Confine all cutting and welding to the designated area in the shop.
7. Turn off torch valves when finished with equipment.
8. Keep the cylinder caps on the bottles when not in use.
9. Turn off gas and oxygen at tanks or stations at the end of class session.
10. Bend the end of long welding rods to identify hot end and to reduce potential exposure to eye injury.



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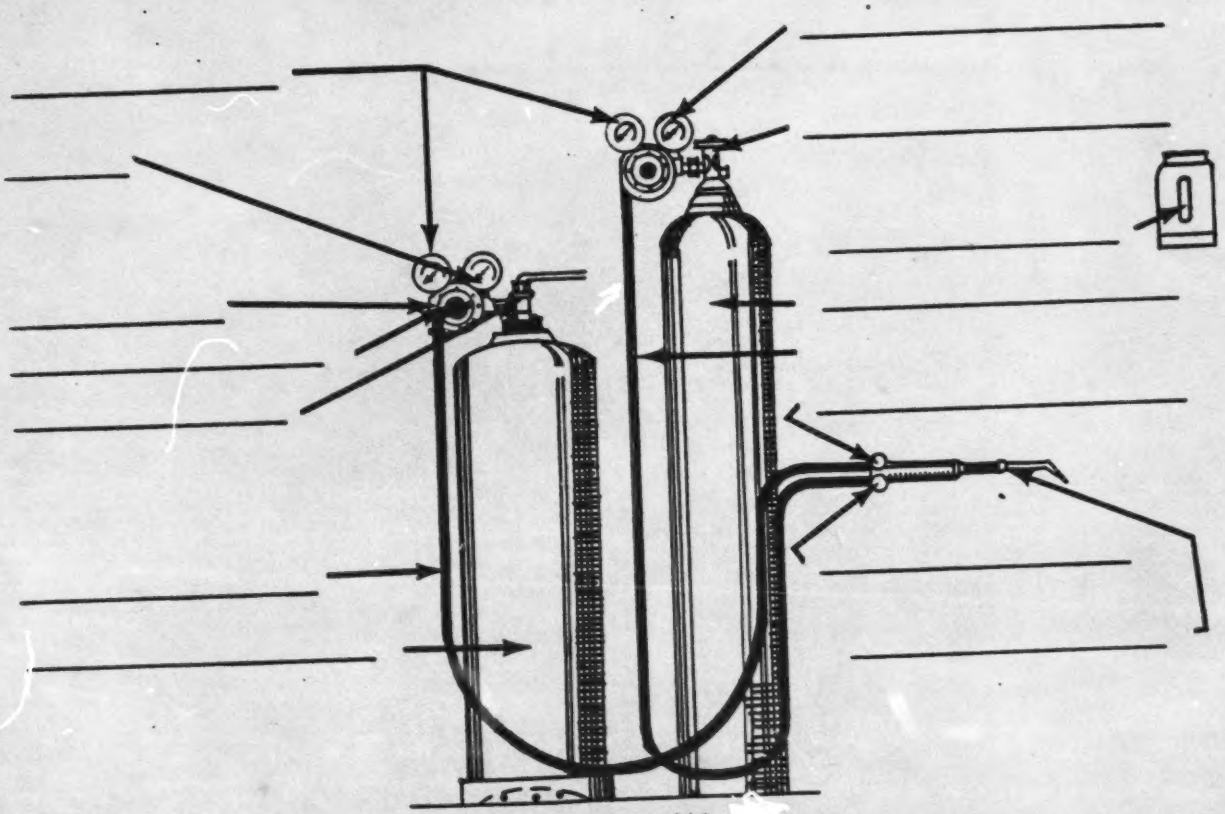
OXY-ACETYLENE WELDER

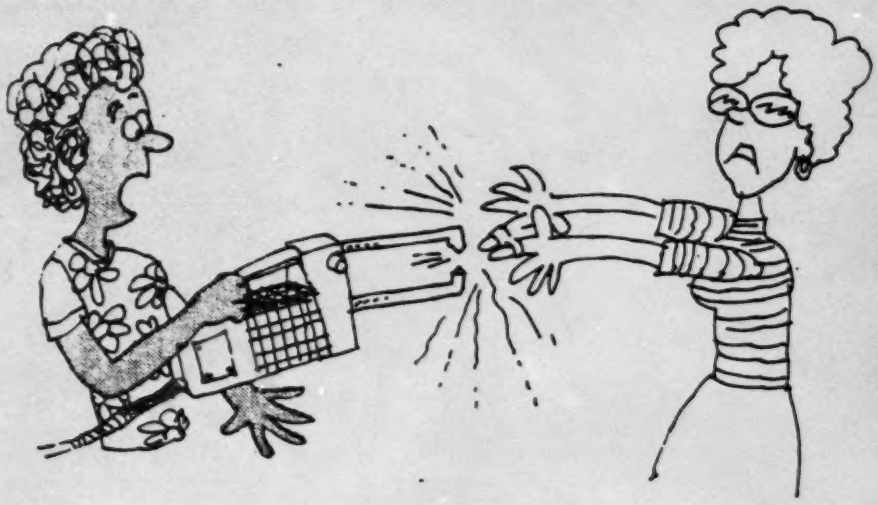
Student Name:_____
Class_____
Date_____Grade_____

SAFETY QUIZ

1.	Gas bottles may be laid on the floor when not in use.	T	F
2.	Closed containers are not hazardous to weld or repair.	T	F
3.	The cylinder caps should be placed on all bottles when not in use.	T	F
4.	Eye protection must be worn for <u>all</u> welding, cutting and chipping operations.	T	F
5.	The equipment should not be wiped down with oily rags.	T	F

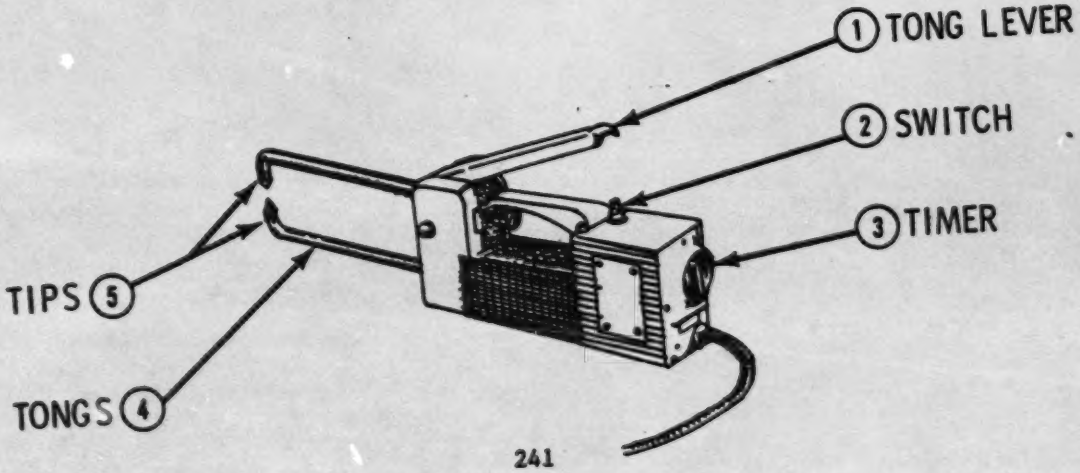


Spot Welder



SAFETY SUGGESTIONS

1. Always wear a protective faceshield, in addition to proper eye protection.
2. Do not weld with wet hands or in a damp area.
3. Do not touch the tips, tongs or welded material after welding, as they become very hot.
4. Never leave the spot welder unattended with the electrical cord plugged in.
5. The metal being spot welded must be clean and dry.
6. When spot welding galvanized material remove the galvanize from the area being welded.

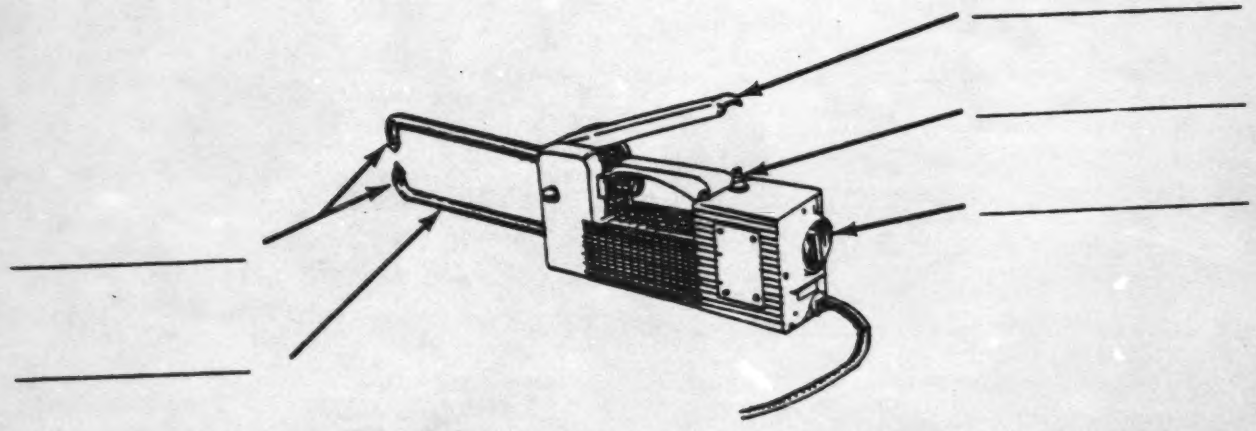


SPOT WELDER

Student Name_____ _____
Class_____ _____
Date_____Grade___ _____

SAFETY QUIZ

1.	The spot welder should be used in a wet damp work area.	T	F
2.	The spot welder should always be left plugged in and the current left on.	T	F
3.	After welding, the tips of the spot welder are very hot.	T	F
4.	The metal being spot welded must be clean and dry.	T	F



APPENDIX C

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B. Olson, Delmar W. Industrial Arts for the General Shop; Third Edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1968.

C. Fales, James, Everett Sheets, Gregg Mervich and John Dinan. Manufacturing a Basic Text for Industrial Arts; McKnight Publishing Company, Bloomington, Illinois, 1980.

D. Curry, E. H. and R. H. Pardonnet, R.W. Symes. General Industrial Arts; D. Van Nostrand Company, Inc., Princeton, New Jersey, 1967.

APPENDIX D

The following project ideas were provided through the courtesy of Bennett Publishing Company.

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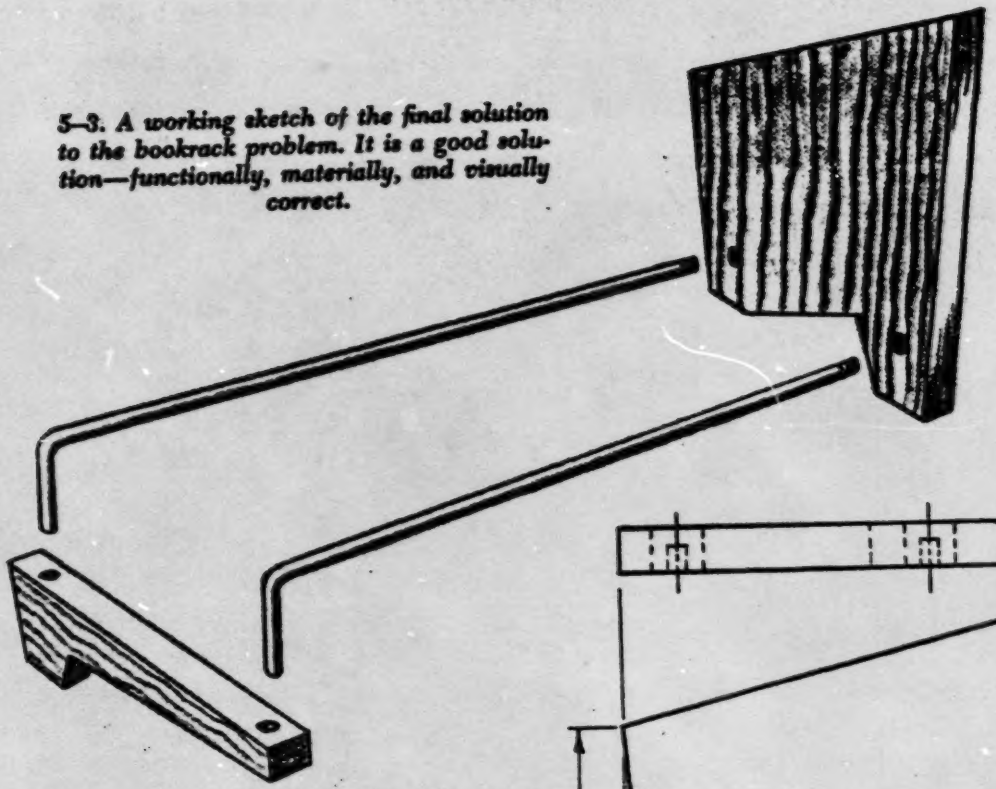
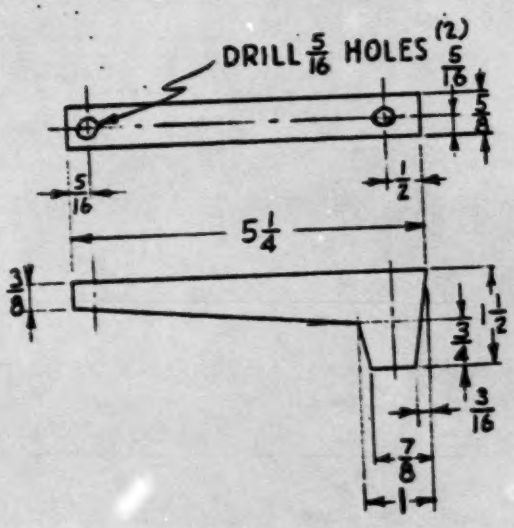
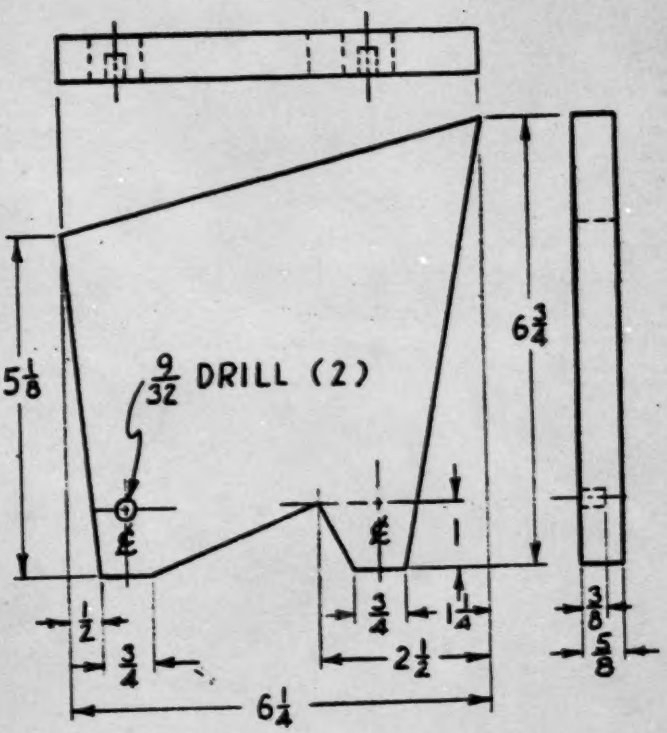
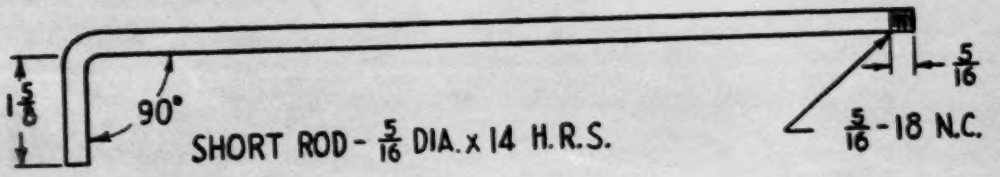
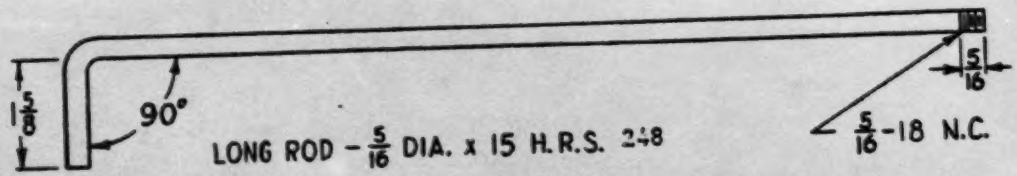
5–3. A working sketch of the final solution to the bookrack problem. It is a good solution—functionally, materially, and visually correct.











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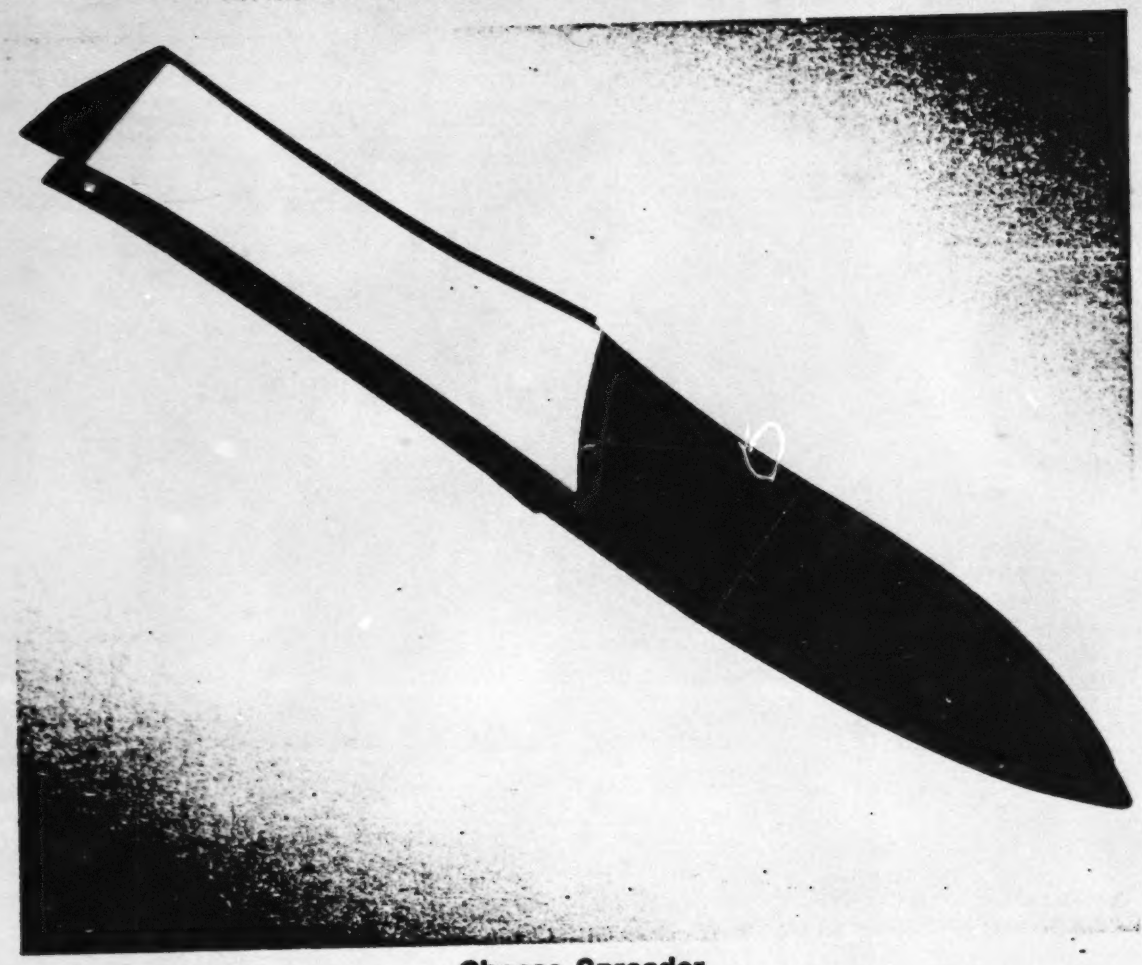
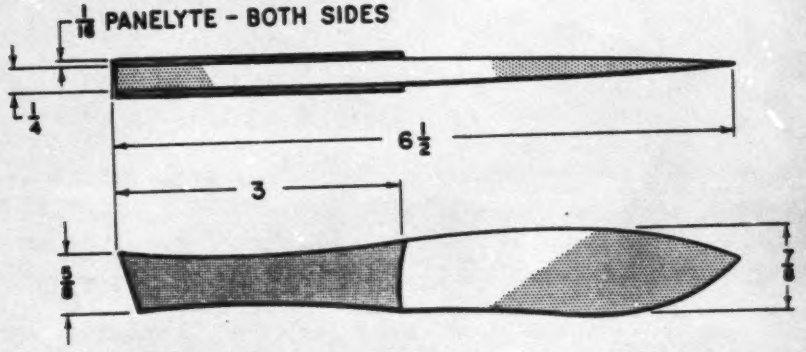


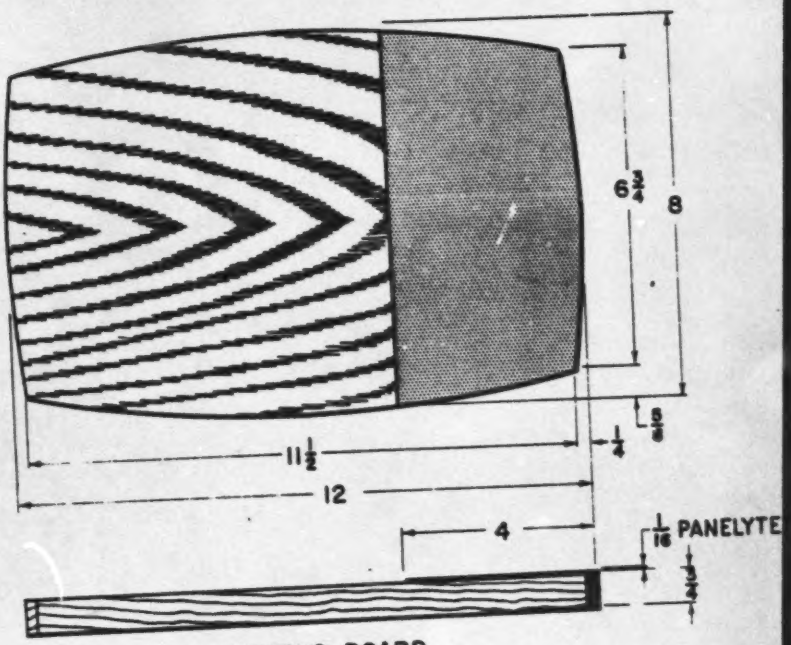
Cheese Spreader

This cheese spreader can be made of wood (as shown) or of plastic or metal. Similar designs can be used for letter openers. The colored plastic laminate (Panelyte) is contact-cemented to the wood, providing an interesting contrast or variety of materials.



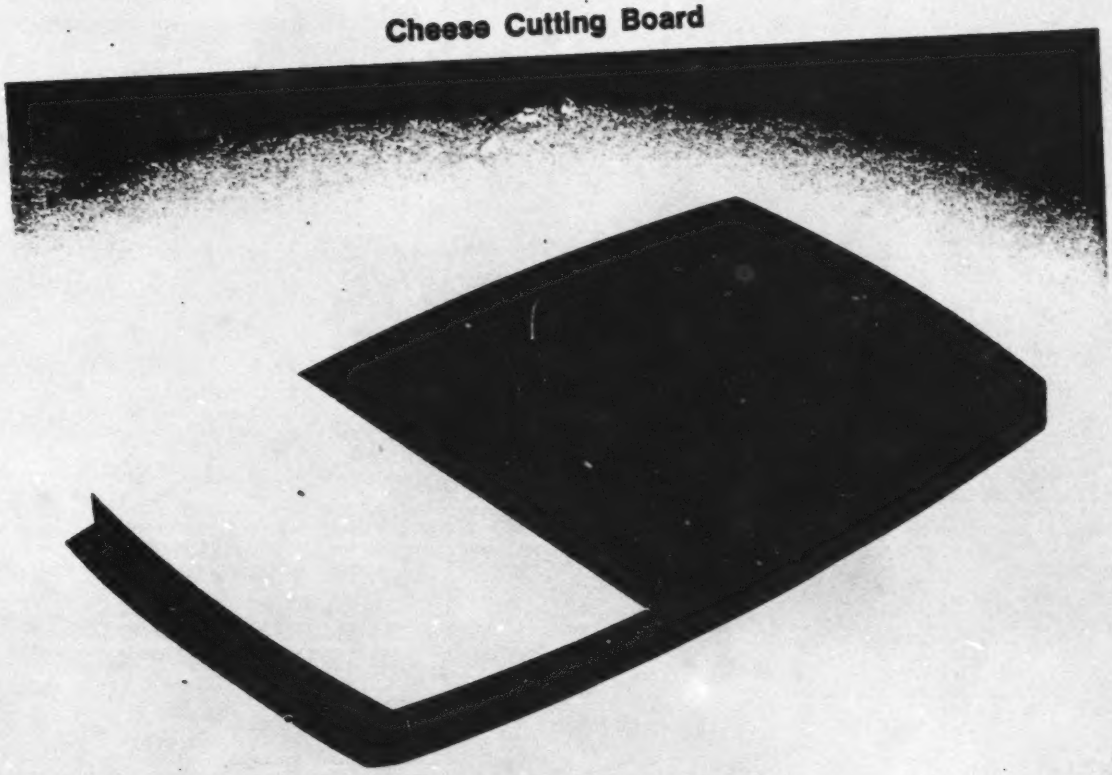
CHEESE SPREADER

The cutting and serving board makes a nice companion piece to the cheese spreader. This is a suggested shape; perhaps you can design one of your own. The plastic laminate is fastened with contact cement.

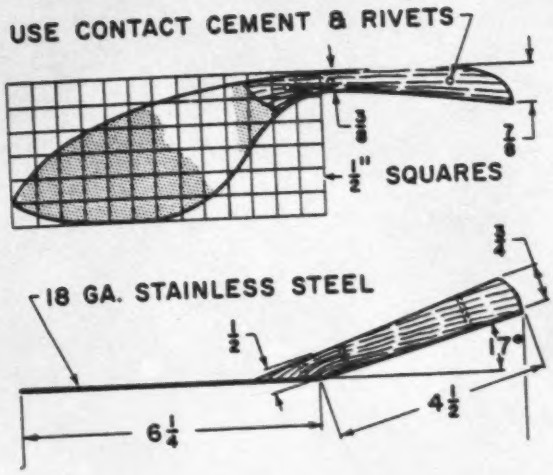


CUTTING BOARD

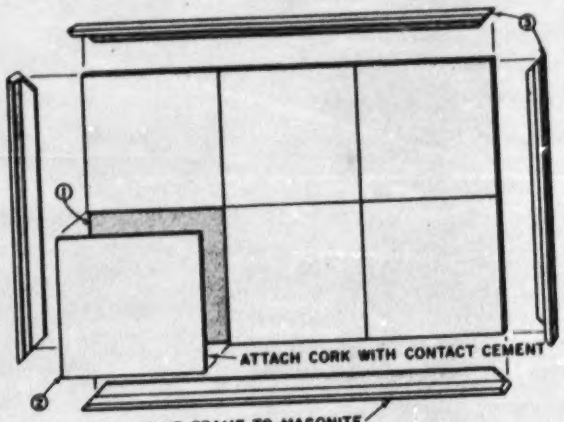
Cheese Cutting Board



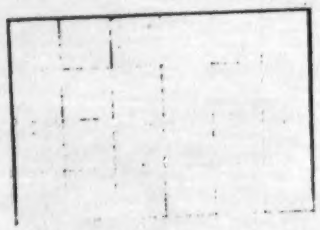
Cake Knife



A combination cake or pie slicer and server is attractive in walnut and stainless steel. Other interesting shapes can be also designed



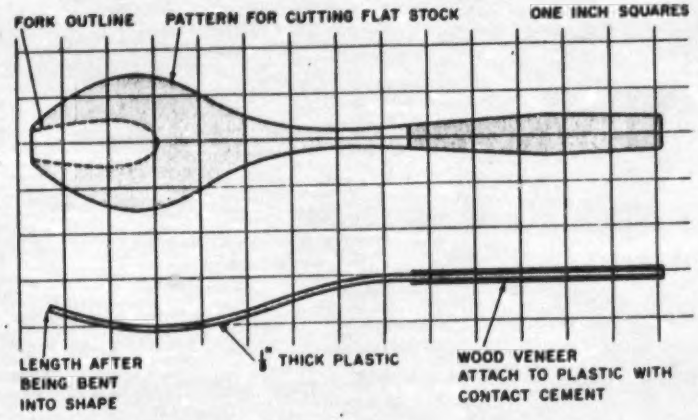
A bulletin board for your room provides a convenient place to display pictures and similar items. This one is made from cork tile and may be made larger or smaller as you desire. Paint the frame to match the woodwork in your room.



Cork Bulletin Board

Salad Tossers

These salad tossers can be made of a variety of colored plastics. The handles can be laminated of contrasting plastic or of wood veneer. Fasten them with contact cement.


FORK OUTLINE
PATTERN FOR CUTTING FLAT STOCK
ONE INCH SQUARES
LENGTH AFTER BEING BENT INTO SHAPE
⅛" THICK PLASTIC
WOOD VENEER ATTACH TO PLASTIC WITH CONTACT CEMENT

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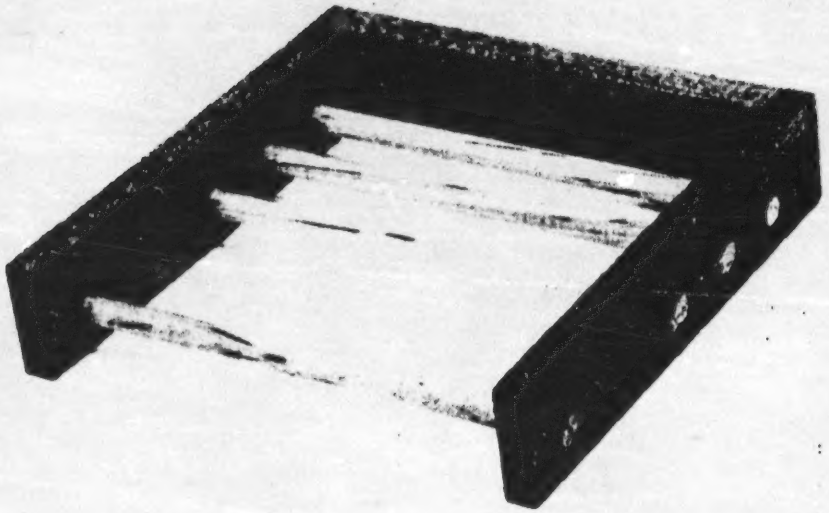
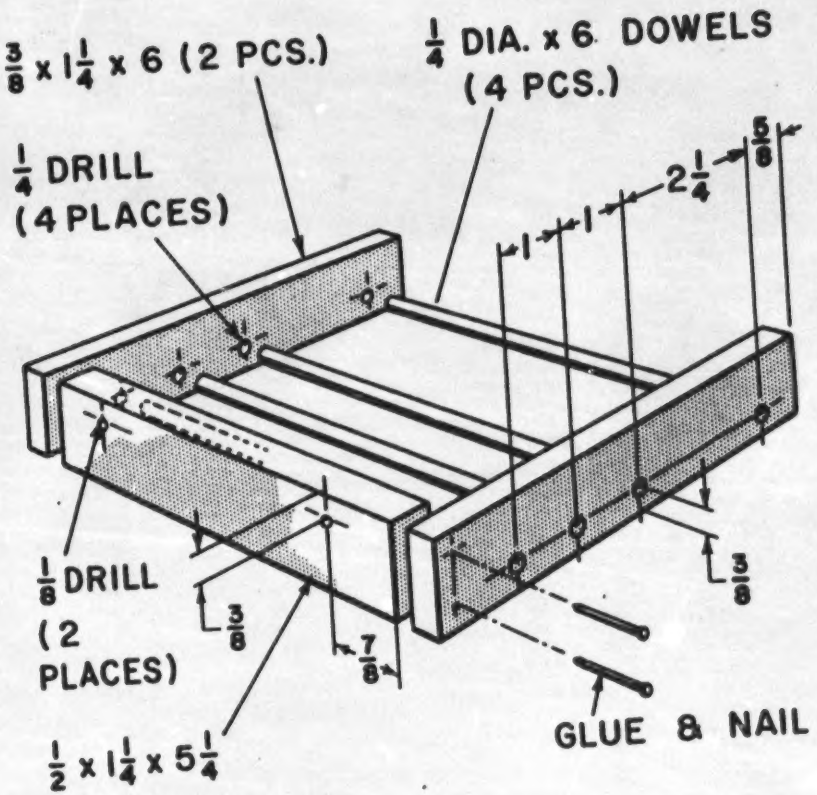
Tie Hangers





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Your ties and belts can be hung neatly in your closet with this simple, attractive tie rack. Contrasting woods may be used. Can you think of some other designs for this project?

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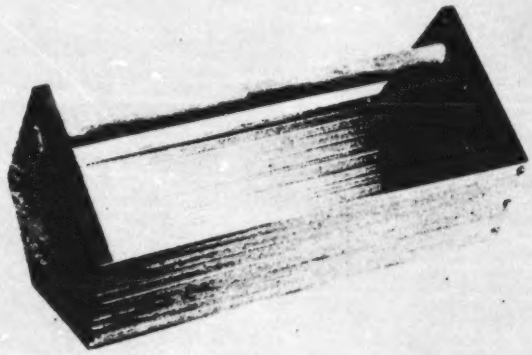
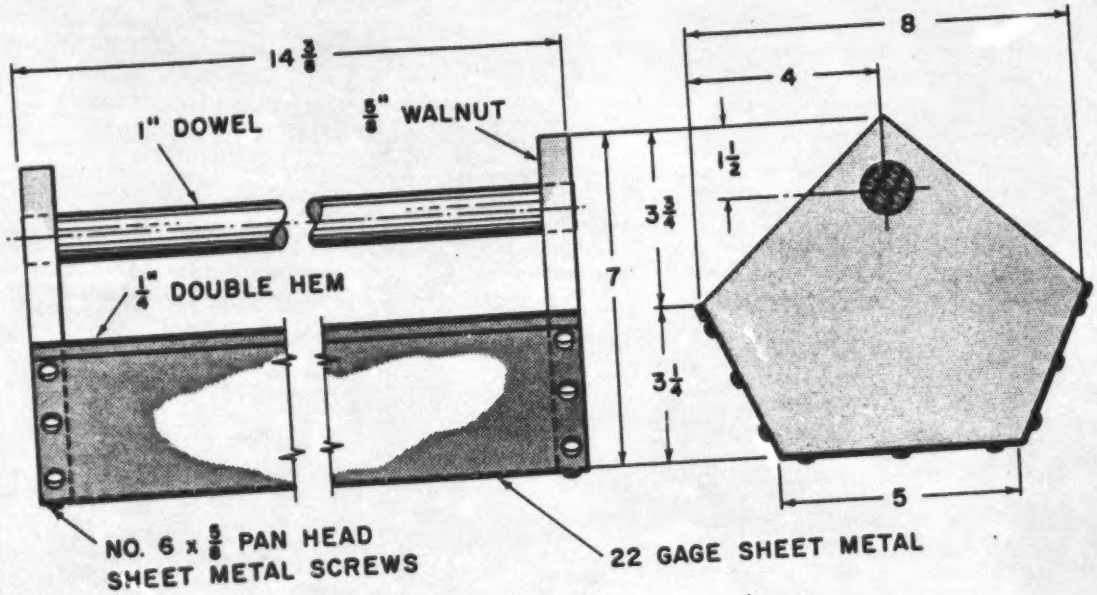
Tote Box

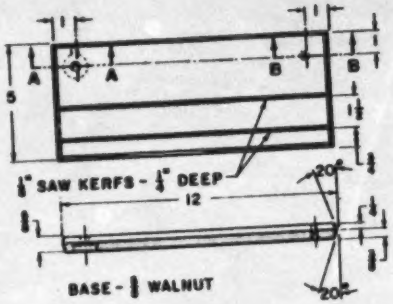
A tote box is convenient for storing and carrying household and garden tools. The size and materials can be varied to fit your tools and tastes.

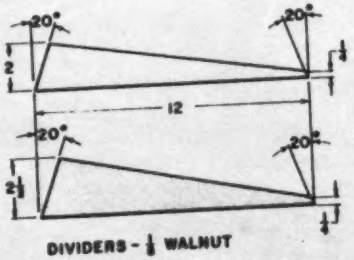


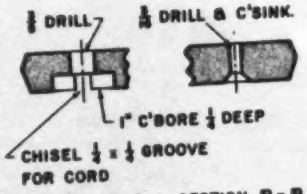


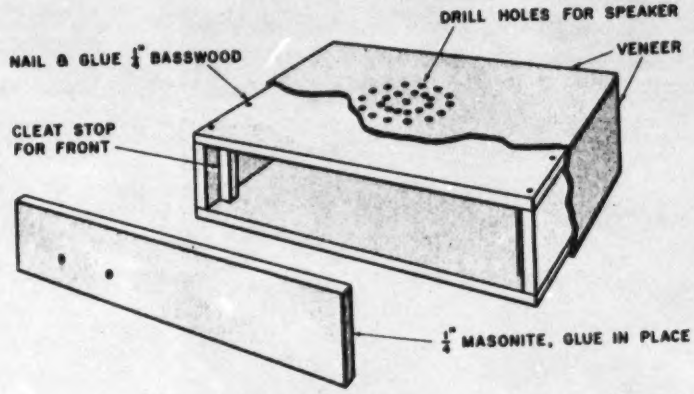
Study Lamp

This interesting study lamp can be made with or without the storage rack for letters and the pen holder. If desired, the rack and the pen holder could be made of the wood shown here. Shades and lamp parts can be purchased from supply houses or lamp shops.



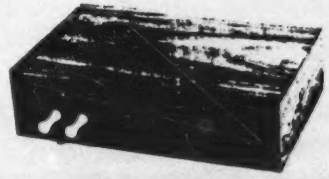




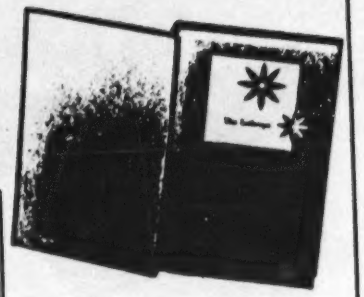


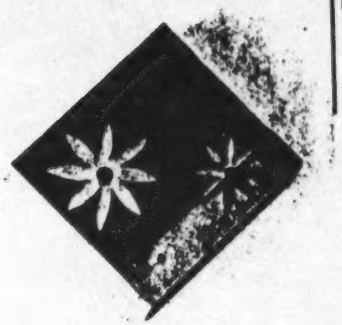
Radio Case

Radio cases of plastic or wood, in many designs, can be made in the shop. You must know the size of the radio chassis, and plan the case accordingly. You can purchase a chassis, or you might decide to make one.



Graphic Arts





Here are some ideas for graphic arts projects.

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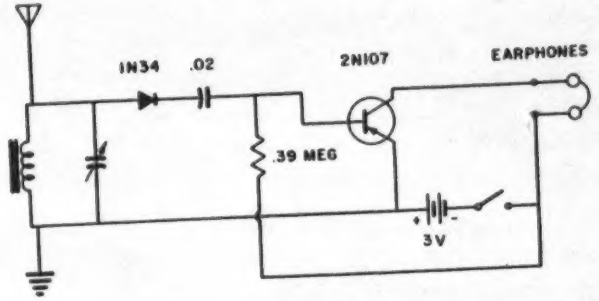
Transistor Radio

This is a typical small transistor radio which you can assemble in the shop. The radio case project can be designed to fit this unit.



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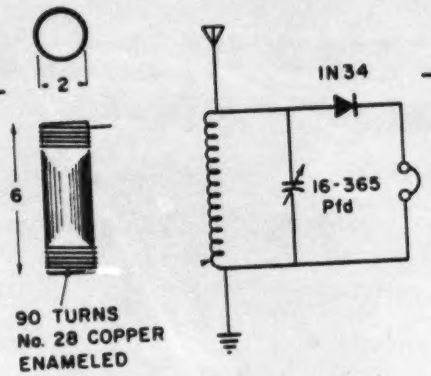
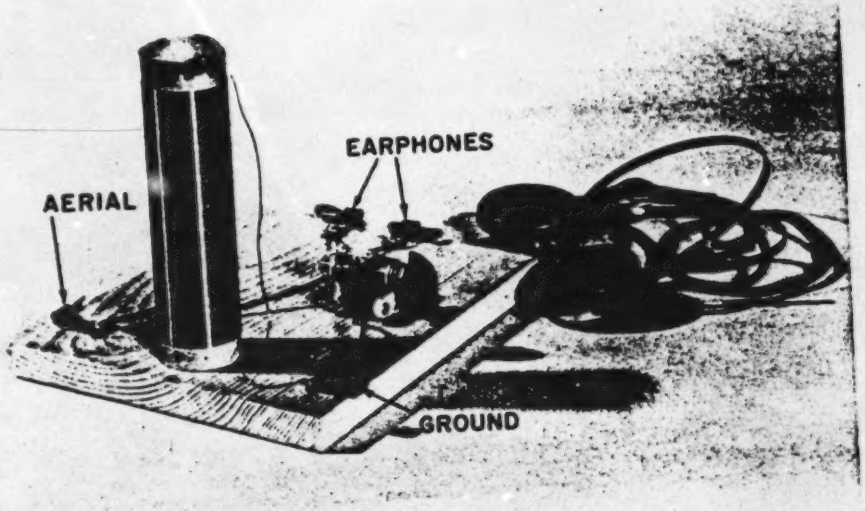


Crystal Radio

You can make this simple crystal radio receiver at home or in the shop. The coil is wound on a cardboard core as from a roll of waxed paper. The other parts may be purchased from a local radio shop.